Climate Change Education Engagement in Annex I Parties' National Communications Within the United Nations Framework Convention on Climate Change

A Thesis Submitted to the
College of Graduate and Postdoctoral Studies
In Partial Fulfillment of the Requirements
For the Degree of Master of Education
In the Department of Educational Foundations
University of Saskatchewan
Saskatoon

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Abstract

There is a shortage of Climate Change Education (CCE)/Action for Climate Empowerment (ACE) policy research in general, particularly in non-formal and informal education settings. Non-formal and informal education plays an essential role in mobilizing society and requires more attention in education policy research. Furthermore, various ideologies and assumptions underlying educational policies have rarely been examined on a broad scale globally.

Drawing data on the 44 education chapters of Annex I Parties' National Communications (NCs) under the United Nations Framework Convention of Climate Change (UNFCCC), this thesis addresses the research gaps through document analysis on Annex I Parties' engagement with practices and policies related to ACE, including signs of the assumptions of economic orientations, ways of learning, and human-nature relationships. Previous literature reveals the inclusion of CCE/ACE content in the existing curriculum. Through the work of this thesis, another engagement within formal education is identified. Apart from CCE/ACE integration into formal education, such as ACE-related content included in degree programmes or courses in tertiary education, training programmes in vocational education, curriculum study in secondary and primary education, as reported in the NCs, extra-curricular learning programmes are also reported intensively in the NCS. The extra-curricular programmes are mainly organized by government agencies and NGOs and operated within schools. These programmes may not belong to any subject curriculum or structured study, but they are reported as offering meaningful ACE learning opportunities and become an indispensable part of ACE learning in formal education.

In non-formal and informal education, the ACE engagement is reported in the content to various ACE elements, including training, public awareness, public access to information, public participation, and international cooperation. These engagements with ACE through non-formal and informal approaches are prevalent across Annex I Parties, primarily reported in the content to the ACE element of public awareness.

This thesis also analyzed assumptions underlying practices and policies in relation to ACE as reported in the NCs. The research findings suggest that the assumptions on a green-economy economic orientation, a neoliberal economic orientation, instrumental learning, participatory learning, an ecologically centered human-nature relationship, and a resourcist human-nature relationship are present in the NCs, with the two economic orientations being the most identified assumptions. In contrast, the two assumptions on the human-nature relationship are rarely identified.

However, due to the limitation of capacity and scale of this study, while the findings respond to previous research gaps, further research is recommended, especially in the CCE/ACE engagement in the public sphere through non-formal and informal approaches. Observing the lack of mention of Indigenous knowledge in NCs across Annex I Parties, it is also recommended to conduct further research to encourage more involvement of Indigenous knowledge in the practices and policies related to ACE. Also, the current reporting structure for Annex I Parties' NCs prefer the ACE activities reported at the national level; the NCs may miss out on comprehensive reporting at the sub-national level where the ACE activities occur in countries characterized as federal states or similar decentralized political system. Therefore, this thesis also recommends the UNFCCC Secretariat to encourage Annex I Parties to report future NCs to report at the geographic levels that suit the country context.

Acknowledgements

I am grateful and proud to be part of the Sustainability Education Policy Network's research team and to participate in the UNESCO CCE monitoring project in the summer of 2018. This UNESCO project focused on investigating the implementation of CCE in-country submissions under the UNFCCC, including National Communications (NCs) and Nationally Determined Contributions (NDCs). Working on an actual research project with a dedicated team truly taught me a lot about researching rigorous data collecting and coding, constructive feedback and communication among team members, and hours of hard work. Most importantly, this UNESCO project inspired me to explore further the topics I would like to explore in my thesis work. Furthermore, in the process of this thesis work, my fellow researchers in SEPN continued to provide endless help for me to sort out the dataset and validate my research findings. A big thank you to Kristen Hargis, Jaylene Murray, and Nicola Chopin for your friendship and solidarity!

I want to thank my husband Aaron for this extended journey of my thesis work due to our second child Skye's arrival and a global COVID-19 pandemic. Without his support, constant encouragement, sharing of housework, and childcare duties, I cannot possibly complete my thesis work through this difficult time. Thank you to my brother-in-law Christian who helped me with English editing, correcting all the misused articles in my writing. I also want to thank my parents, who took many risks to travel to Canada amid the pandemic, to stay with us and help us with childcare. All this sacrifice and help gave me so much comfort and confidence to complete my thesis work. The love and support from my family are truly unique!

I would also like to thank my thoughtful, caring, meticulous supervisor Dr. Marcia McKenzie. You have taught me so much about conducting research and writing a proper academic paper. Thank you for teaching me about commas and the writing of concise and powerful sentences. Thank you for all the SEPN meetings you coordinated and the sense of community these meetings provided to me.

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List of Abbreviations

Abbreviations	Explanation
ACE	Action for Climate Empowerment
APA	American Psychological Association
CCE	Climate Change Education
COP	Conference of the Parties
EE	Environmental Education
ESD	Education for Sustainable Development
ESE	Environment and Sustainability Education
GAP	Global Action Programme
GHG	Greenhouse Gas
IPCC	Intergovernmental Panel on Climate Change Report
ISFS	United States Forest Service
NAAEE	North American Association for Environmental Education
NAP	National Adaptation Plans
NASA	National Aeronautics and Space Administration
NC	National Communications
NDC	National Determined Contributions
NGO	Non-Governmental Organizations
OECD	Organization for Economic Cooperation and Development
RES	Renewable Energy Sources
SDG	Sustainable Development Goals
SEPN	Sustainability and Education Policy Network
UNFCCC	United Nations Framework Convention on Climate Change
USFS	United States Forest Service

Chapter 1: Introduction

Background and Research Questions

Anthropogenic climate change has become a pressing concern since the effects of human activities on the natural environment have escalated (Henderson et al., 2017; IPCC, 2018; UNESCO, 2016). According to the Intergovernmental Panel on Climate Change Report (IPCC, 2018), the projected 1.5°C of global warming above pre-industrial levels in the next decade will have a widespread impact on human life and ecosystems. Unless climate change mitigation expands rapidly in the next decade, we will see increasingly extreme weather conditions. The increased temperature will result in the further loss of biodiversity and ecosystems, rising sea levels, and risks to health, livelihoods, and food security. Thus, the need to mitigate anthropogenic CO_2 emissions and adapt to climate uncertainty in the future is urgent. Citizens and societies need to be prepared and mobilized at all levels, and Climate Change Education (CCE), including "education, training, public awareness," can contribute to this (UNFCCC, 1992, p. 17).

The 1992 United Nations Framework Convention on Climate Change (the UNFCCC or the Convention) lay the foundation for multilateral actions combating climate change and its adverse impacts on humanity and ecosystems. The countries committed to the Convention, called Parties, are divided into Annex I Parties, Annex II Parties, and Non-Annex Parties based on their economic development scales and their commitment levels to the Convention. Annex I Parties include 44 relatively wealthy countries, including members of the Organization for Economic Cooperation and Development (OECD) in 1992, plus the Russian Federation, the Baltic states, and several central and eastern European states. These countries "have higher per capita emissions than most developing countries and have greater financial and institutional capacity to address climate change" (UNFCCC, 2006, p. 46). Annex I Parties have the highest commitment to the Convention, including submitting National Communications (NCs) in a four-year interval and an inventory of their greenhouse gas (GHG) emissions. Annex II Parties contain countries who were OECD members in 1992 and non-Annex I Parties were developing countries. Article 6 of the Convention outlines the expectations that Parties promote CCE in their respective home countries and help developing countries deal with climate change challenges through educational support (UNFCCC, 1992, p. 17).

According to Article 6 in the Convention (UNFCCC, 1992, p.17), the education required to raise climate change awareness is comprised of six focused elements that promote knowledge and attitudes towards climate change and its effects. These six focused elements are identified and prioritized as education, training, public awareness, public access to information, public participation, and international cooperation. A series of global policy frameworks have been established for further adoption of Article 6 since the Convention (see Table 1), including Article 10(e) of Kyoto Protocol (1997, p. 10) and Article 12 of the Paris Agreement (2015, p. 16), among others. These global policy frameworks have laid the international groundwork for implementing Article 6. They have provided platforms for the Parties to communicate and share experiences, ideas, successes, and failures during the implementation process. Article 6 of the Convention is renamed "Action for Climate Empowerment" (ACE) in 2015, with the six focused elements of Article 6 included as the elements of ACE (UNESCO & UNFCCC, 2016, p. 2).

Table 1.1.

UNFCCC Article 6 Adoption Timeline (UNESCO & UNFCCC, 2016, pp. 2-5; UNFCCC, 2017; UNFCCC, 2018a; UNFCCC, n.d.)

Year	Event	Activity
1992	UNFCCC adopted	UNFCCC adopted, including Article 6.
1997	Kyoto Protocol adopted	Article 6 of UNFCCC was emphasized in Article 10(e) of the Kyoto Protocol.
2002	New Delhi Work Programme (2002-2007) adopted	UNFCCC Parties adopted the New Delhi Work Programme on Article 6.
2007	Conference of the UNFCCC Parties (COP)13 in Bali	UNFCCC Parties extended the timeframe of New Delhi Work Programme for five years (2007-2012) and requested that regional workshops be organized by the UNFCCC secretariat.
2009	Regional workshops on Article 6 organized by UNFCCC Secretariat	Regional workshops on Article 6 held in Asia, the Pacific, and Europe.
2010	Regional workshops on Article 6 organized by UNFCCC Secretariat	Regional workshops on Article 6 held in Small Island Developing States, Africa, Latin America and the Caribbean.

2012	COP 18 in Doha	UNFCCC Parties adopted the eight-year Doha Work Programme (2012-2020) on Article 6 of UNFCCC and agreed to organize annual dialogue on Article 6 to strengthen this work.
2015	COP 21 in Paris	3rd dialogue on Article 6, ACE was chosen as popular name for Article 6; Parties reaffirm the importance of education, training and public awareness under Article 12 of Paris Agreement.
2016	4th dialogue on Article 6 in Bonn	Intermediate review of the Doha Work Programme was completed.
2017	5th dialogue on Article 6 in Bonn	
2018	6th dialogue on Article 6 in Bonn	

As part of their pledge to the Convention, the Parties need to share information about implementing the Convention for evaluation, assessment, and progress monitoring (UNFCCC, 2000b, p. 80). Annex I Parties to the Convention (UNFCCC, 1992, p. 32) are bound to submit NCs to the UNFCCC every four years. These reports outline actions taken by respective countries towards climate change mitigation and adaptation in the national context and the policies and measures in several key sectors, such as finance, technology, research, and education. One whole chapter in each Annex I Parties' NC is devoted to "education, training, and public awareness" (UNFCCC, 2000b, p. 98). It provides information on the countries' activities, particularly regarding the six elements of ACE.

Related to the UNFCCC effort on ACE, or what can also be described as CCE, there have been broader UN efforts to further sustainability education. Læssøe and Mochizuki (2015) outlined the emergence of Education for Sustainable Development (ESD) and CCE (defined by them as 'climate change education'). ESD has mainly been built up through the UN Decade of ESD between 2005 and 2014 and in the Global Action Programme (GAP) for ESD since 2015 (UNESCO, 2016). Halfway through the UN Decade of ESD, UNESCO (2010) highlighted three themes: climate change, biodiversity and desertification, and cultural diversity. After that, UNESCO launched a flagship programme called Climate Change Education for Sustainable

Development in 2010, symbolizing the beginning of ESD's focus towards CCE (Læssøe & Mochizuki, 2015, p. 28).

In a comprehensive literature review of environmental and sustainability education policy research, Aikens, McKenzie, and Vaughter (2016) reported an absence of CCE-focused policy research before 1995. There was still low engagement with CCE policy research after the Kyoto Protocol was adopted in 1997. For example, in the first five years post-Kyoto, only one article in the literature they reviewed mentioned climate change (Aikens et al., 2016, p. 341). Further studies involving CCE policy have appeared since 2006, but as a relatively new research focus, literature specifically on national or international CCE policy and practices is sparse (Henderson et al., 2017; Lovett et al., 2018). In another ESD policy study carried out by the International Alliance of Leading Education Institutes in 2009, Læssøe and Mochizuki (2015) also confirmed that the national CCE policy was not receiving enough attention in the research literature (p. 29).

Partially addressing this gap, in 2018, UNESCO commissioned the Sustainability and Education Policy Network (SEPN) to conduct a CCE monitoring study on four types of UNFCCC submissions. These UNFCCC submissions analyzed included NCs of both Annex I and Non-Annex I Parties, as well as the first rounds of National Determined Contributions (NDC) and National Adaptation Plans (NAP) (UNESCO, 2019; McKenzie, 2021). SEPN and UNESCO's study aimed to determine UNFCCC member Parties' engagement with the ACE elements and climate change-related Sustainable Development Goals (SDG) targets 4.7 and 13.3/12.8. That study provided the monitoring and evaluation of CCE engagement and recommendations for future country submissions. Building on SEPN and UNESCO's findings on the extent and type of countries' engagement with CCE/ACE, this thesis conducted further qualitative analysis on what this engagement looked like within and across countries.

I have limited my thesis study scope to Annex I Parties' NCs because they have a clearly defined education chapter to report their actions related to ACE elements (UNFCCC, 2000b, p. 98). Limiting the study's scope enables more insights into the countries' CCE engagement, whereas information about education is fragmented or scattered in other types of UNFCCC submissions (UNESCO, 2019, p. 4). My main research question is: How do Annex I Parties approach ACE, or CCE, as reported in UNFCCC national communications? My research question is addressed through three sub-questions: (i) How are Annex I Parties engaged with the six ACE elements, as reported in the NCs? (ii) How are Annex I Parties engaged with policies in

relation to ACE, as reported in the NCs? (iii) What assumptions are embedded in Annex I Parties' reported ACE practices and policies?

Personal Contexts

I am originally from China, but I have worked and lived in Zambia, Norway, and China in the last decade. I immigrated to Canada in 2015 to join my family. I have worked on various community development and environmental projects in my professional career path, including poverty alleviation programmes, non-formal education, and a wildlife conservation education programme. These experiences contributed to my understanding of different aspects of sustainable development, motivating me to consider what is required to build a sustainable society. Having a reciprocal relationship with nature and other beings, understanding the harmful effects of neoliberal economic mechanisms exhausting our collaborative environment and resources, and promoting unity instead of segregation have become my core beliefs.

I am also a climate change activist. I have supported climate justice and involved myself in related activism for years. However, before I started my Master's programme, I lacked the adequate tools to critically analyze the social and economic influences that worsened the climate change phenomenon. I did not see the link between the prevailing economic paradigm and most social and environmental challenges. Through my Master's studies, I have learned to think more critically. I also believe that the only way to prevent ourselves and our planet from being destroyed by climate change is to dramatically change our perspective on both our relationship to the natural world and each other. In my view, education should be positioned at the center of this transition and process of change.

My home country of China has become the leading greenhouse gas emitter globally since 2007 (Guo & Marinova, 2011, as cited in Han, 2015, p. 63). When I worked with environmental education (EE) and animal welfare programmes in non-governmental organizations (NGOs) in China, we were often invited to schools as part of moral education or quality curriculum. Such programmes were generally marginalized and considered the least important in the mainstream educational curriculum, dominated by learning outcomes, competencies, and pressure to perform on university entrance exams. I understand the critical role policies play in formal and non-formal education. EE/ESD/CCE programmes will only flourish when educational policy supports them.

I believe it is meaningful to do education policy research about CCE, to be able to analyze policy and its impact on practice and the long-term consequences on social constructs, to influence future policymaking, and catalyze societal change. My personal and professional experiences helped me better understand rapidly emerging climate change education concerns and motivate me in my thesis research. Hopefully, my work will contribute to the academic community, policymakers, intergovernmental organizations, and broader audiences.

Chapter 2: Literature Review

This literature review delves into the main areas of prior research that are relevant to the thesis study. It provides an overview of previous climate communication and education (CCE) policy and practice related studies, either within one country or across countries, with five main themes identified from this prior literature: i) barriers to incorporating CCE/ACE into policy; ii) government and other actors' roles in CCE/ACE engagement; iii) research on CCE/ACE practices; iv) the importance of assumption analyses in education policy research; and v) methodology for researching CCE/ACE policy. In what follows, I will summarize the literature in each of these five areas.

Barriers to Incorporating CCE/ACE into Policy

The need for CCE/ACE and policies engaging with CCE/ACE emerged out of the necessity to combat the growing global challenges of climate change (UNESCO, 2010, p. 17). While searching for studies on CCE policy for this review, it became evident that they were often embedded within broader investigations of EE and ESD policy[1] (e.g., Blum et al., 2013; Læssøe et al., 2009; Læssøe & Mochizuki, 2015; Lovett et al., 2018). Therefore, it is crucial to understand how EE and ESD have been included in national and regional policies, according to existing research, before turning expressly to the literature on the development and enactment of CCE policies.

The literature suggested that many countries had attempted to incorporate EE and ESD into national or regional educational policy through interdisciplinary versus subject-specific approaches (Aikens et al., 2016; Lovett et al., 2018), with limited success on mainstreaming EE and ESD (Aikens et al., 2016, p. 345). Instead, an interdisciplinary approach had further marginalized sustainability in the curriculum in many cases. For example, ESD had been described as a (hyper)specialized add-on knowledge in an overcrowded curriculum (Jucker, 2011, p. 41). Due to these challenges in associating EE/ESD with interdisciplinary curricula, in practice, EE and ESD were found to be mainly aligned with science education, except for a few policy studies that reported their inclusion in social science curricula (Aikens et al., 2016, p. 346). Indeed, since its early development, EE has had a strong alliance with science-based

[1] For the purpose of this review, 'policy' was considered beyond policy texts and encompass the influences on policy development and the implementation and enactment of policy (Braun et al., 2010, p. 586; McKenzie et al., 2015, p. 319).

conservation, which was promoted by featured environmentalists such as Bill Stapp and the international organization and programmes he led (Aikens et al., 2016, p. 346). Endorsements from influential people and organizations laid the cornerstone for the later development of ESD and its relationship with science education (Aikens et al., 2016, p. 346).

Additional barriers to mainstreaming ESD were numerous, including competition with other educational priorities in the policies, lack of clear policy mandates, and insufficient support for teachers. In many contexts, the primary educational goal has been to prepare students for examinations and emphasize standardized testing (Aikens et al., 2016, p. 348; Læssøe et al., 2009, p. 21). Thus, ESD was treated as an extra burden to the already overcrowded curriculum without clear mandates at the policy level (Læssøe et al., 2009, p. 22). In the Netherlands, ESD was outside the formal education system and was mainly delivered by non-governmental organizations (NGOs) (Lovett et al., 2018, p. 212). Another example of ESD being marginalized was the hesitation to execute a whole-school approach to sustainability progressively (e.g., in teaching, overall school governance, on school infrastructure), despite the recognized effectiveness of this holistic approach (Aikens et al., 2016, p. 346). Another barrier to mainstreaming ESD was the lack of support for teachers. Often, teachers' enthusiasm led to the success of ESD (Kennelly et al., 2008, p. 62). However, due to the non-mandatory nature of ESD in many contexts, teachers did not receive the necessary support in terms of resources, time, and training (Aikens et al., 2016; Læssøe et al., 2009). Therefore, even with political will and specific ESD policies, ESD policies were often neglected in implementation.

As an emerging research field, CCE and its development intersected with EE and ESD. The need to conceptualize CCE further grew in emphasis within research and policy on EE and ESD (Blum et al., 2013, p. 210). Nonetheless, with the long-standing debate and discussions on the conceptualization and relationship of EE and ESD, perceptions of EE, ESD, and CCE included diverse interpretations and meanings that were influenced by unique national contexts and international factors (Blum et al., 2013). Some prior studies (e.g., Blum et al., 2013; Læssøe et al., 2009; Læssøe & Mochizuki, 2015; Lovett et al., 2018) asserted that CCE was inherently embedded in ESD. Indeed, although CCE had started to be identified in its own right, it did not gain its footing in the educational system; instead, it often operated as a theme within existing programmes and initiatives of EE and ESD (Blum et al., 2013; Læssøe et al., 2009; Lovett et al., 2018). The relationship between CCE and ESD is complicated. Læssøe and Mochizuki (2015)

suggested that there were three trends between CCE and ESD policies: CCE and ESD policies were designed unrelated or partially related to each other; CCE policies were integrated with ESD policies by being developed under or overlapping with the existing ESD policies; and CCE policies were originated from ESD policies but were developed independently from them when the national focus shifted to climate change adaptation and mitigation (pp. 33-36). These trends further complicated the relationship between CCE and ESD.

Moreover, the prior studies suggested that CCE's social aspects were beneficial for ESD's development, and they worked the best when CCE remained an integral part of ESD. Aligned with science education-focused EE and ESD, CCE was predominantly blended into science education (Læssøe et al., 2009, pp. 14-15). The emphasis on the science aspect of CCE caused new concerns. Sauvé, Berryman, and Brunelle (2007) critiqued the instrumental perspective that viewed ESD as a problem solver for environmental and sustainability issues (p. 37). They argued that the instrumental view of ESD reduced education to merely providing knowledge, skills, and solutions for immediate problem solving while neglecting other essential aspects of education, such as critical reflection and independent thinking. Scholars also recognized that CCE should entail more social, economic, and cultural factors than scientific knowledge about climate change (Lovett et al., 2018, p. 210). According to Læssøe et al. (2009), these aspects of CCE can go beyond the instrumental narrative and respond to social issues. When CCE remained an integral part of ESD, the responses towards social elements in CCE enhanced ESD in empowering actions and decision-making (Læssøe et al., 2009, p. 15). Læssøe and Mochizuki (2015) contended that CCE helped advance ESD when incorporated into ESD. For example, the CCE focused on promoting green skills through technical and vocational education and training expanded the economic dimension of ESD, and the disaster risk reduction emphasis in CCE introduced competencies such as "resilience, coping and managing skills in ESD" (Læssøe & Mochhizuki, 2015, p. 38).

In sum, as EE and ESD are not yet mainstreamed in educational policies, this has also had an impact on CCE. Challenges to carrying out interdisciplinary curriculum, competition with other academic priorities, lack of a national mandate, and insufficient support for teachers were difficult to overcome. As an embedded concept in ESD, CCE has been an integral part of ESD programmes, and some literature suggested it was best to remain that way (Læssøe et al., 2009, p. 15). CCE's social aspect and green skill foci enhanced ESD's focus on "empowerment of

actions and decision-making" (Læssøe et al., 2009, p. 15), which was beneficial for developing both ESD and CCE educational policies.

Government and Other Actors' Roles in CCE/ACE Engagement

The existing literature suggested that governance styles determined which level of government was a key actor in CCE policymaking within various countries (Feinstein, Jacobi, & Lotz-Sisitka, 2013; Læssøe & Mochizuki, 2015; Lovett et al., 2018). Countries with centralized national educational governance had more nationwide power over policymaking and implementation. For example, the French government's centralized education structure allowed it to consolidate the CCE programme under the national Ministry of Education (Lovett et al., 2018, p. 214). Decentralized or federated education governance afforded provincial or state-level governments more flexibility to employ the most suitable approach. For instance, Belgium's decentralized system enabled different non-state actors to provide teaching and learning tools for CCE (Lovett et al., 2018, p. 215). Each governance style had different benefits in implementing CCE.

In some cases, decentralized governance was not an option but a constitutional requirement because national governments lacked the constitutional grounds to regulate policy in federal states (Feinstein, Jacobi, & Lotz-Sisitka, 2013, p. 221). Even when a national policy was in place, it often had a limited impact on execution due to a lack of centralized management. It resulted in overly vague or inconsistent implementation (Feinstein, Jacobi, & Lotz-Sisitka, 2013, p. 221). However, the countries that shared similar governance styles did not necessarily have the same approach to CCE. Feinstein, Jacobi, and Lotz-Sisitka (2013) found that due to specific historical and cultural contexts, CCE engagement varied in countries that were similarly characterized as having "decentralized educational governance" (p. 219), namely Brazil, South Africa, and the USA. In another study on environment and sustainability education (ESE) in a federated country, Aikens and McKenzie (2021) revealed a localized, relevant, Indigenous-focused ESE initiative in a northern territory in Canada, providing a unique perspective to global sustainability education initiatives.

Soft governance was another aspect of effective governance suggested by prior literature, but it equally had its limitation in engaging CCE policies. Læssøe and Mochizuki (2015) contended that soft governance was needed when dealing with ESD and CCE strategies at the national level. This type of governance enabled state ministries and agencies to involve other

stakeholders, coordinated the initiatives that promote ESD and CCE, and supported these initiatives with resources, materials, and information (Læssøe & Mochizuki, 2015, pp. 36-37). However, a well-established governance supporting structure did not necessarily bring about successful practices, as it was generally "too weak to ensure a mainstreaming of ESD and CCE" (Læssøe & Mochizuki, 2015, p. 38).

Nevertheless, CCE engagement relied on the cooperation between governments and other key actors such as civil society, regardless of whether it was at the national or different geographic levels. For example, according to Feinstein, Jacobi, and Lotz-Sisitka (2013), NGOs played the principal role in the U.S. to plan and operate ESD programmes, with the federal government functioning as a financial supporter (p. 223). It was a different scenario in Brazil where civil society organizations had equal legal responsibility and rights to all levels of government and other institutions in terms of ESD implementation. The Brazilian federal government played a supportive role by building the network infrastructure and ensuring performance (Feinstein, Jacobi, & Lotz-Sisitka, 2013). Similarly, because of its unique historical context, NGOs and government in South Africa had been intertwined in policymaking since the beginning of the country's independence in 1910 (Feinstein, Jacobi, & Lotz-Sisitka, 2013).

In addition to examining government and other actors that influenced CCE engagement in various countries, the existing literature also focused on pressures and influences on the development of policies. These influences included internal pressures from local governments, media, public opinions, government ideology, and external pressures from international CCE policies (Blum et al., 2013; Læssøe & Mochizuki, 2015; Lovett et al., 2018). Internally, a government's political or economic ideology affected its engagement with CCE policy (Blum et al., 2013; Lovett et al., 2018). For example, Lovett et al. (2018) observed the CCE policy alteration in the United Kingdom when the Conservative government took over from the New Labour government, shifting a progressive attitude towards CCE to a passive attitude (p. 211). Henderson et al. (2017) identified that post-secondary education institutions prioritized energy consumption reduction while neglecting the other sustainability domains such as governance, education, research, and community outreach due to the national economic context (pp. 15-17). Externally, international events had been found to create opportunities to advance CCE policy in the national context, as demonstrated in Denmark before they hosted the UN climate change conference in 2009 (Blum et al., 2013, p. 212) and France before they hosted COP 21 in 2015

(Lovett et al., 2018, p. 213). However, the attention caused by external pressure usually proved to be short-term, disappearing once the pressure was removed (Blum et al., 2013).

In sum, the existing literature suggested that factors to consider in countries' CCE engagement included the level of government that can influence CCE inclusion, governance styles, the relationship between governments and other actors, and the ideologies governments support. Although uncommon, international pressure was another factor that can affect CCE policy engagement.

Research on CCE/ACE Practices

There was a relative absence of research on CCE/ACE practices in formal and non-formal education settings (Blum et al., 2013; Læssøe & Mochizuki, 2015; Monroe et al., 2019; Wibeck, 2014). Blum et al. (2013) noted that the lack of studies on ESD and CCE practices at the classroom level despite the rich conceptualization of these two terms and supportive policies enacted at various jurisdictional levels. Læssøe and Mochizuki (2015) asserted that the imbalance between policy and implementations, suggesting that CCE policies do not automatically translate into practices (p. 28). Blum et al. (2013) argued that the absence of ESD and CCE practice research was in part due to much of the existing 'research' at the time being carried out as part of ESD and CCE programmes evaluation processes. Most ESD and CCE programme evaluations were carried out by NGOs that did not analyze the programme by "exploratory and long-term research" but rather through "narrowly focused investigations of educational practice" (Blum et al., 2013, p. 213). In a systematic literature review of research on CCE interventions, Monroe et al. (2019) noted that most of the reviewed studies focused on school-based programmes and how CCE was engaged within the public sphere through informal and non-formal education remained to be explored. Nevertheless, Anderson (2012) suggested that CCE interventions were most successful when they focused on climate change issues in a local context and were personally relevant (p. 197).

Monroe et al. (2019) concluded that specific strategies could enhance CCE programmes and better inform teachers' and educators' work in the formal education system. In line with the design for successful EE programmes defined by North American Association for Environmental Education (NAAEE), the authors outlined that personal relevance and engagement were two critical indicators of a good CCE programme (Monroe et al., 2019, p. 799). Climate change issues were more tangible and understandable when the teachings focused on events in the

learners' local context, such as within their communities, schools, and day-to-day lives. Also, interventions with an "experiential, inquiry-based, or constructivist approach" supported interactive teaching methods (Monroe et al., 2019, p. 800). Interactive teaching methods empowered, engaged, and allowed students to co-produce knowledge. These two strategies of personal relevance and engagement enabled good education in many ways. Still, they alone were insufficient in addressing a culturally and politically controversial issue such as climate change. Monroe et al. (2019) further identified four additional strategies that enhanced the learners' knowledge and understanding of climate change. First, the learners were allowed to interact with and learn from other opinions about climate change through discussions. Second, the students gained first-hand experiences and knowledge from climate scientists. Third, programmes were designed to address misconceptions about climate change directly. Finally, students were involved in climate change-related projects in their communities and schools. These identified strategies would benefit CCE programmes within the formal education system.

Through a literature review on climate change communication and education, Wibeck's (2014) work provided insights on CCE in non-formal settings where the public became informed about climate-related issues and became engaged with climate actions through strategic activities. Wibeck (2014) suggested a transition from enhancing public knowledge towards encouraging public engagement in science communication, including CCE in non-formal settings (p. 391). The shift to action-oriented climate communication meant motivating participatory actions was becoming more popular than merely sharing scientific information (Wibeck, 2014, p. 391). Wibeck (2014) further asserted that the public could be engaged in three ways: changing their lifestyle, executing their political influence by making consumption choices, supporting climate-friendly policies, and participating in the policy-making process (p. 394). Although it was challenging to increase the public's engagement due to their climate literacy level, sociocultural factors, and sense of agency, educators can increase communication effectiveness by incorporating specific strategies into their teaching (Wibeck, 2014, p. 398).

Interestingly, Wibeck (2014) recommended replacing "fear-based communication" (p. 398) with positive solutions that addressed climate issues in the audiences' immediate environments. Another way of increasing communication effectiveness was to make the climate issues more visible through visualization such as metaphors and images. Choosing innovative ways to frame the message was yet another effective tactic. For example, communicating climate

change-related issues as public health concerns rather than environmental problems were more efficient to mobilize people who were not interested in environmental issues. Finally, dividing the audience into various target groups to precisely frame messages in ways that different audiences responded to was another effective tactic to increase engagement (Wibeck, 2014, pp. 398-402). Engaging the public through positive, visualized, personally relevant, and audience-specific messages can increase their participation in the CCE public awareness activities.

In conclusion, despite the scarcity of research on CCE/ACE implementation in formal and non-formal education settings, existing studies have focused on identifying the effective strategies to promote CCE. Personal relevance, student engagement, exposure to opposite opinions, first-hand scientific experiences, and community projects' involvement contributed to a well-received CCE programme in the formal education system. Similarly, public engagement in CCE can also be boosted by framing communication with positive, visualized, personally relevant, and audience-specific content.

The Importance of Assumption Analyses in Education Policy Research

Prior studies have revealed that numerous ideologies and assumptions underlay educational institutions (Bowers, 2007), international education recommendations and guidelines (Sauvé et al., 2007), and education policies (McKenzie et al., 2015). These ideologies and assumptions range according to different historical and cultural contexts. They represent various value systems (Bowers, 2007) and influence cultural and social perceptions on EE and sustainability education (Bowers, 2007; McKenzie et al., 2015; Sauvé et al., 2007). For example, Bowers (2007) suggested that an ecologically centered ideology emphasizes interconnectedness among humans, cultural patterns, and the natural environment (p. 103), values traditional knowledge, and contributes to a long-term sustainable relationship with the environment (p. 4). Bowers (2007) stated that two forms of liberalism have dominated educational reforms in modern Western society. These forms of liberalism share cultural assumptions such as anthropocentrism and a belief in the inherently progressive nature of change. These anthropocentric views also value scientific and technologically-based knowledge as the highest form of knowledge (Bowers, 2007, pp. 111-113) and accentuate education's instrumental role (Sauvé et al., 2007, p. 37). Sauvé et al. (2007) noticed that this type of thinking is present among many intergovernmental organizations, who promote "environmental sciences and technological transfers, coupled with sustained economic growth" as the primary solutions for environmental

problems, and therefore, the critical competencies for ecological education (p. 39). This type of view also reduces the environment to resources that serve the welfare of humans (Bowers, 2007; Sauvé et al., 2007), contributing to "an anthropocentric, resourcist, and neo-liberal ideology" (Sauvé et al., 2007, p. 38) of modern education.

Furthermore, neoliberalism as a dominant economic paradigm influences all social domains, including education and education policy (McKenzie et al., 2015). For example, Sauvé et al. (2007) asserted that neoliberalism accomplishes its mission of "increas[ing] productivity and competitiveness" in education (p. 38). The growing impact of neoliberalism in education is evident in public policies, including education and sustainability policies in post-secondary education, in the process of economic globalization (McKenzie et al., 2015, p. 325). Moreover, like Peck, Theodore, and Brenner (2012) observed, the inherent feature of neoliberalism, such as uneven development, results in a lack of formulated models across locations and scales (p. 271). Instead, various forms of neoliberalization can be found due to the tension between "contextually specific neoliberalization projects and inherited politico-institutional arrangements" (Peck et al., 2012, p. 271). As such, neoliberalism in education can be observed in many forms. McKenzie et al. (2015) pointed out that various forms of education governance result from neoliberal market-based competition and commodification. The manifestations of neoliberalization in education include political authority from the emphasis on the state to that of a global education policy field, privatization of education administration management, and the increasing privatization in education policy and policy processes (McKenzie et al., 2015, pp. 325-326).

In some cases, the implications and consequences of the ideologies of education and education policies are found to remain to be discovered or examined (Læssøe et al., 2013, p. 235). Liberalism ideology leads to a "modern technologically oriented consumerist lifestyle" and the destruction of ecologically sustainable communities, furthering today's environmental crisis (Bowers, 2007, p. 37). Nevertheless, scientific and technologically-based knowledge is promoted and spread by the modern education system and elite groups. As a result, there is a lack of critical examinations on how this form of expertise accelerates the ecological crisis (Bowers, 2007, p. 37). Li (2003) also observed that necessary inquiries into the underlying assumptions of globalization are not promoted in the curriculum reform (p. 62). However, the "moral dimension" of language can explicitly demonstrate the user's understanding of relationships (Bowers, 2007, p. 99) and reveal their cultural assumptions or ideologies. For instance, Sauvé et

al. (2007) suggested that the trend to use the word "learning" instead of "education" in intergovernmental organizations' documents is indicative of the neoliberal ideology and its commodification of the process of education (p. 39). Similarly, "sustainable development" or "sustainability" is used to greenwash the neoliberal economic policies that deepened the financial and ecological crisis (McKenzie et al., 2015, p. 320).

Identifying, analyzing, and understanding such ideologies and assumptions in education policy is essential as it could reveal the connections between assumptions and approaches. Læssøe et al. (2013) described that "[theoretical] analysis show[s] how policies may subtly reinforce certain institutions and ideational systems and can help us anticipate (and perhaps avoid) the perverse, inequitable consequences of particular policy regimes" (p. 235). It is particularly crucial for nations that employed international educational recommendations and guidelines in the current context of globalization. They need to interrogate the ideological foundations underlying these global initiatives to gain legitimized ground to integrate them into national initiatives (Sauvé et al., 2007, p. 34).

In sum, prior studies acknowledged several ideologies and assumptions in education and education policy. For example, an ecologically-centered ideology promotes a holistic relationship among human individuals, cultural patterns, and nature. Meanwhile, a resourcist ideology regards the environment as resources and education as an instrument, and a neoliberal ideology understands modern education as a commodity. These assumptions may be explicit or implicit in an international educational guideline or an education policy. Therefore, identifying them is helpful to understand a country's engagement or disengagement with specific education policies. As a result, the analyses of ideologies and assumptions have been significant in education policy research concerned with the environment, as overviewed above.

Methodologies for Researching CCE/ACE Policy

As a final section reviewing related literature, the research methodology and methods for EE studies (including ESD and CCE) were reviewed. Several studies reported comparative research on national or international CCE policy (e.g., Bieler et al., 2017; Blum et al., 2013; Læssøe & Mochizuki, 2015; Lovett et al., 2018). In these comparative studies, a multiple case study approach was commonly employed, including a range of methods such as interviews, observation, survey, or others (e.g., Blum et al., 2013; Feinstein, Jacobi, & Lotz-Sisitka, 2013; Læssøe & Mochizuki, 2015; Lovett et al. 2018). International comparison and analysis of CCE

policy were helpful for researchers, policymakers, and practitioners at some level, as through comparison among nations, researchers could identify "emergent trends and themes as well as significant variations and specific phenomena considered to have wider relevance" (Feinstein, Læssøe, et al., 2013, p. 202). However, Feinstein, Jacobi, and Lotz-Sisitka (2013) raised concerns about the practicality of such work in countries characterized by decentralized governance. They suggested that international comparison analysis would only make sense when "both the centers of influence that populate[d] each polycentric system and the historical conditions that ha[d] made them into systems" were considered (p. 225).

Also, having documents as the stand-alone data source was suitable for some "specialized forms of qualitative research" (Bowen, 2009, p. 29). For example, one approach to CCE policy research was document content analysis, which employed documents as the only source of data (e.g., Bieler et al., 2017; Henderson et al., 2017; Pizmony-Levy, McDermott, & Copeland, 2021; Zacharious & Korfiatis, 2021).

Læssøe et al. (2013) recommended two methodological approaches to policy research: the documentation type of policy research and engaged and interactive policy research (p. 231). The former style emphasized policy research's documentary role that recorded and reflected the contexts explicitly. They further asserted that considering the cultural role of research, researchers could offer theoretical analyses and critically challenge policy actors' ideological roots and hidden assumptions (pp. 234 - 235). Furthermore, researchers needed to interrogate the ideology embedded in the policies and examine the full circle of the policy process, and the documentation research contributed to these goals (Læssøe et al., 2013, p. 235). The latter type focused on the collaboration between researchers and policymakers to enhance "empirical research, theory development, and policy development" (Læssøe et al., 2013, p. 232).

The literature also revealed that the way researchers produced knowledge intersected with "the standards, interests, and time frame[s]" of various policy stakeholders, such as government, private sectors, intergovernmental organizations, and schools (Læssøe et al., 2013; Zacharious & Korfiatis, 2021). Notably, in facing the emerging climate change challenges, researchers' academic involvement in policy development was believed to provide valuable international, national, and local recommendations (Læssøe et al., 2013, p. 232). Collaboration existed between ESD and CCE policy research and various stakeholders as well (e.g., Læssøe et al., 2013; Læssøe & Mochizuki, 2015; UNESCO, 2019). Læssøe et al. (2013) admitted that it was

inevitable or unnecessary to position researchers as critically detached from policymaking. However, it was crucial to maintain research integrity when allying with other stakeholders in the policy process to guarantee the research was "neither (exclusively) critically detached nor naively involved" (Læssøe et al., 2013, p. 233). On the other hand, not only policy research informs policymaking, but ESD policy can also illuminate gaps in policy research, as indicated in a Cypriote research on sustainability education research and policy relationship (Zacharious & Korfiatis, 2021).

In sum, a review of the prior research methodologies and methods used for studying climate change education policy included examples of comparative research, case study, and collaborative methodologies. Methods included documentary analysis, interviews, and other data collection methods in the case study and participatory approaches. Several studies also indicated it was critical to consider how researchers positioned themselves in interacting with other stakeholders with whom they co-produced knowledge in CCE.

Summary

This literature review provides an overview of previous CCE/ACE policy and practice related studies, either within one country or among countries, and sometimes in relation to ESD and/or EE, including five main aspects: i) barriers to incorporating CCE/ACE into education policies; ii) government and other actors' roles in CCE/ACE engagement; iii) research on CCE/ACE practices; iv) the importance of assumption analyses in education policy research, and; v) methodology for researching CCE/ACE policy.

This review reported on research findings in the field and identified the existing research gaps in the study of CCE/ACE. There was a shortage of CCE/ACE policy research in general, but particularly in non-formal education settings. Informal and non-formal education plays an essential role in mobilizing society and requires more attention in education policy research. Furthermore, international comparative policy analysis in relation to CCE/ACE has rarely been done on a broad scale globally, nor have the various ideologies and assumptions underlying educational policies been examined on such a scale. Therefore, this thesis addresses these gaps by investigating CCE/ACE policies and practices, including in formal and non-formal settings globally, and includes an analysis of the underpinning assumptions. It also takes a comparative approach to analyzing materials from a range of countries, through a document content analysis approach.

Chapter 3: Methodology and Research Methods

In order to understand my three research questions, my thesis adopted a document content analysis as the research method. My research questions included how Annex I Parties engaged with CCE, or ACE, from both practice and policy aspects as reported in their NCs under the UNFCCC, and what assumptions underlay these reported practices and policies. In the following sections, I will describe the methodology, data collection methods, data analysis methods, writing strategies, and validation strategies used in my thesis study, as well as ethical considerations.

Methodology

My methodological framework follows previous CCE/ACE policy research work within the Sustainability and Education Policy Network (SEPN), employing document content analysis (e.g., Bieler et al., 2017; Henderson et al., 2017). For qualitative research, using documents as data has advantages such as stability, cost-effectiveness, efficiency, and availability (Bowen, 2009, p. 31; Merriam & Tisdell, 2015, p. 155). However, disadvantages and limitations are also inherently embedded in this type of data collection and data analysis, such as insufficient detail, low retrievability, and biased selectivity (Bowen, 2009, p. 32). Since the documents are produced for reasons other than for research, they pose challenges for determining the "authenticity and accuracy" of the information as there are likely "built-in biases" in the content that cannot be removed and that I may not be aware of (Merriam & Tisdell, 2015, p. 154). To counteract this disadvantage, Bowen (2009) suggests using triangulation of data to increase credibility. Unfortunately, documents were the stand-alone sources of data for my thesis work. I could not triangulate data as this research lacked the capacity or sufficient resources to cross-reference with other data; this is likely an inherent limitation in my thesis research. However, document content analysis helps me in identifying "meaningful and relevant passages of text or other data" through the "process of organizing information into categories related to the central questions of the research" (Bowen, 2009, p. 32). In what follows, I provide a detailed description of the data collection and data analysis methods used in the document analysis.

Data Collection Methods

My document dataset included the most recent NCs submitted by 44 Annex I Parties under the UNFCCC (as of June 2018), all publicly available on the UNFCCC website. The study

NCs were written in various official UN languages, including 39 reported in English, 3 in Russian, 1 in French, and 1 in Spanish. While the country submissions covered a range of topic areas related to the UNFCCC, this study focused on the reports' education chapters, typically the final chapter, or Chapter 9, of the NCs. For the 3 NCs written in Russian, the education chapters were uploaded to data management software NVivo as is, and a Russian-speaking researcher assisted with the coding. The two education chapters from NCs written in French and Spanish were translated using online translation software and were uploaded to NVivo. The 39 education chapters from NCs reported in English were uploaded directly to NVivo.

Data Analysis Methods

This thesis work has undertaken two phases of data analysis. The first phase of data analysis was part of the UNESCO study analyzing policies and practices in relation to ACE through UNFCCC country submissions from Annex I and non-Annex I Parties (UNESCO, 2019; McKenzie, 2021). The UNESCO study was carried out by SEPN's research team, who conducted a content analysis using a collaborative thematic coding process, as employed in many other SEPN's education policy research work (e.g., Henderson et al., 2017; Vaughter et al., 2016). A total of 368 country submissions were analyzed in the UNESCO study, of which 44 NCs submitted by Annex I Parties were the same dataset for this thesis study. The UNESCO study dataset was coded using a common codebook collaboratively developed by the SEPN research team (see Appendix B). Out of 44 Annex I Parties' NCs, I completed coding for a total of 22 out of 41of NCs written in or translated into English, while the other English-speaking coder coded the rest of the study documents in English, and the Russian-speaking coder completed coding for 3 NCs written in Russian. Subsequently, inter-coder reliability checks were conducted during our collaborative coding process to ensure coding accuracy when multiple coders were involved.

This thesis research was built on the UNESCO study in the same dataset of 44 Annex I Parties' NCs. However, the second phase of the data analysis was specific to my thesis research and was completed by myself. The coding extended beyond the initial SEPN coding scheme to provide more nuanced analyses and results from those in the UNESCO study. To examine the specific research questions in this thesis study, I undertook three steps to document content analysis of the data. First, I created an additional coding scheme (see Appendix C). In this additional coding scheme, the codes of "actors" were developed inductively based on themes that

emerged, and the codes of "assumptions" were developed deductively concerning the literature. Moreover, I extended the coding for the codes of "learning dimensions," which previously applied to the "ACE element of education" in the initial SEPN's coding for the UNESCO study, to all other ACE elements in the second phase of the data analysis. I completed the additional coding for all 44 study documents.

After completing additional coding, I produced frequency counts for all the codes regarding the ACE elements from initial coding for the UNESCO study, including regarding additional coding on policies and assumptions. The frequency counts for the codes quantified "both the breadth [and] representation of particular codes" across Annex I Parties and "the overall frequency with which codes appeared in the dataset" (Henderson et al., 2017, pp. 8-9). The subsequent analysis involved 11 matrix coding queries (see Table 2). Matrix coding queries allowed "pairs of items [to be] cross-tabulated and displayed as a matrix" and provided "frequencies of responses for each row-column combination" (Bazeley & Jackson, 2013, pp. 250-251). In my thesis study, the ACE elements were used as rows in the matrix coding queries in NVivo; geographic level, target audience, actors, learning dimensions, and assumptions were set as columns, respectively. I then ran a series of matrix coding queries to get each row-column combination's responses.

Table 3.1.

List of Matrix Coding Queries Included in the Analysis

1	ACE elements by geographic level
2	ACE elements by target audience
3	ACE elements by actors
4	ACE elements by learning dimensions
5	ACE elements by policies
6	ACE elements by Policies by geographic level
7	ACE elements by Policies by target audience
8	ACE elements by Policies by actors
9	ACE elements by Policies by learning dimensions
10	ACE elements by Policies by assumptions
11	ACE elements by assumptions

Subsequently, I reviewed and interpreted the matrix coding query results concerning my research questions. The results for the matrix coding queries listed in Table 2 were divided into three sets based on the research questions they addressed: ACE elements matrix coding queries (1-5), policies in relation to ACE matrix coding queries (6-9), and assumptions matrix coding queries (10-11). The detailed matrix coding query results can be reviewed in Appendix D.

In the third step of my data analysis, I undertook a thematic analysis by going through the query results for each set of matrix coding queries, abstracting and consolidating meaning in the form of emergent themes (Saldana, 2016, p. 10). The text coded to "national ACE strategy" in UNESCO study and "CCE-related policies" in additional coding was reviewed and analyzed to comprehend the understanding of Annex I Parties' engagement with reported policies in relation to ACE, including the type of the policy and focused ACE elements in the reported ACE-related policies.

Despite the constraints of time and resources and the number of documents (44) to work with, I was still able to gain significant insights that addressed my research questions through document content analysis, suggesting the implications for future international and national policy research in relation to ACE.

Writing Strategies

The writing strategies interwoven in my writing included "reflexivity and representation, audience, encoding, and quotes" (Creswell & Poth, 2018, p. 225). First, a researcher's interpretation can be very personal. I correctly positioned myself as a researcher by disclosing my values, biases, and experience that might influence how I interpreted and understood the study. My reflection was placed at the beginning of this report as a "personal vignette" (Creswell & Poth, 2018, p. 230) to serve this purpose.

Second, the target audience determined the writing and encoding style. My target audiences mainly consist of CCE/ACE policy researchers. Thus, the thesis was more academically focused, with a detailed description of research methods and data analysis, while identifying research gaps and providing recommendations. Other potential audiences include intergovernmental organizations, CCE/ACE policymakers, and educators interested in CCE/ACE engagement and implementation across nations. In that regard, I also had more factual insights to offer "practical suggestions for better procedures or reform of existing practices" (Creswell &

Poth, 2018, p. 230). To reach both intended audiences, mobilizing the knowledge produced in my research will be necessary. Apart from writing up my thesis for my Master's degree and a published paper, I also plan to present my research results at environmental education conferences where stakeholders from policymaking, academia, and practice intersect. I want to use the conferences as opportunities to start a conversation between policymakers and practitioners by inviting both to my presentation.

Finally, I combine both "embedded quotes" and "paragraph-long quotes" (Creswell & Poth, 2018, pp. 232-233) as the quoting styles in my thesis writing. The former is primarily used to reference the literature, and the latter is employed for significant examples from data to signify the themes. I also employ a general academic writing structure in the thesis. This structure includes an introduction, a literature review, research methods, research findings, and implications and significance.

Validity

Despite various perspectives on validation for qualitative research, there is no doubt that validation in qualitative research can help ensure the rigor of research (Creswell & Poth, 2018, p. 254). Moreover, there are strategies and techniques to provide a process of validation. According to Creswell (2016), the validation strategies can be organized into three groups by the lenses the approach represented: the researcher's lenses, the participants' lenses, and the readers' lenses (as cited in Creswell & Poth, 2018, p. 259). Engaging with at least two of these validation strategies is recommended (Creswell & Poth, 2018, p. 259). The researcher and readers' validation in this thesis work is particularly valuable, as there are no study participants. In this regard, from the researcher's lens, validation is achieved through "clarify(ing) researcher bias or engaging in reflexivity" (Creswell & Poth, 2018, p. 260). From the readers' lenses, validation is performed through a peer review for data and research process from my colleagues and supervisor.

Moreover, I follow four methodological standards to evaluate the quality of my study. First, as "research questions drive the data collection and analysis" (Creswell & Poth, 2018, p. 266), I have adhered to my research questions and expanded my analysis and understanding around them. Second, to ensure "the data collection and analysis techniques competently applied" (p. 267), I conduct a rigorous document content analysis, using NVivo to help manage the coding and matrix coding queries, as well as undertaking a thematic analysis. Third, "the study [should] have value both in informing and improving practice" (p. 267), which fits with

my aim of informing policymaking processes and practitioners with this study. Finally, "the researcher's assumptions [should be] made explicit" (p. 267), which align with my understanding that all research is influenced by the assumptions and interpretations of the researcher, and thus the value of laying these out as fully as possible for the readers, as I have tried to do.

Ethical Considerations

The thesis research involves studying and analyzing documents obtained from an intergovernmental organization's website. There is no direct interaction with human beings or their biological material; thus, there are no individual participants in this study. However, I should nonetheless stress ethical considerations in writing and publishing activities. The thesis is original, honest, and follows "appropriate writing strategies" and "ethical publishing practices" (Creswell & Poth, 2018, p. 227). For example, I identify target audiences and selected functional language accordingly as part of formal academic writing. I avoid plagiarizing by accurately referencing material, write in an honest and trustworthy fashion, ensuring that I would not submit more than one publication with the same material, and disclose any potential conflicts of interest. Finally, my thesis study builds upon SEPN and UNESCO's (2019) CCE monitoring study that was commissioned to SEPN. I referenced some of the key findings from SEPN and UNESCO's study following citation rules of the American Psychological Association (APA) style and being mindful of SEPN's relationship and ongoing work with staff members at the UNESCO and UNFCCC.

Chapter 4: Research Findings

This chapter summarizes the research findings concerning my three research questions. The first research question focuses on the extent of Annex I Parties' engagement with the six ACE elements as reported in the NCs under the UNFCCC, namely education, training, public awareness, public access to information, public participation, and international cooperation (UNESCO & UNFCCC, 2016). ACE-related content is coded to one or more ACE elements defined as 1) education, both curriculum and extra-curriculum education related to the ACE activities are commonly reported at various education levels; 2) training, mainly reporting on the professional training; 3) public awareness, focusing on reporting green-economy topics, comprehensive coverage for the audience, and external drivers; 4) public access to information, including general information, practical information, and labeling programmes; 5) public participation, reporting on both top-down and bottom-up approaches for public involvement; 6) international cooperation, including international aid, exchange of experiences, collaborative educational programmes, and international programmes. In response to question one, I also identify three themes across the six ACE elements in the findings: 1) geographic trends; 2) government and other actors' roles; 3) the relative focus of learning dimensions.

The second research question focuses on Annex I Parties' engagement with policies to achieve action on various ACE elements. Three main types of policies identified in the dataset concerning the ACE content are: 1) national curriculum frameworks, 2) national laws and legislation, and 3) national strategic plans. Throughout the study documents, national curriculum frameworks are associated only with the ACE element of education. In contrast, national laws and legislation are reported for the ACE elements of education and public access to information. Additionally, national strategic plans are discussed in relation to the ACE elements of education, public awareness, public access to information, and general references to the ACE elements. However, no policy types are identified concerning the ACE elements of training, public participation, or international cooperation in the study documents. Moreover, some other policy documents that do not belong to the above three main policy types, such as action plans and government guidelines, are referenced in relation to ACE in the study documents. These mentions include the ACE elements of education, public awareness, public access to information, and general references to the ACE elements.

The third research question focuses on the assumptions underlying practices and policies in relation to ACE, as discussed in NCs. However, as there is limited content specific to policies that belayed assumptions, the analysis focus on the assumptions underpinning the ACE elements more generally. The content coded to the ACE elements for question one and that coded to policies for question two is examined regarding evidence of six assumption types developed deductively from the review of previous literature. These assumptions include: 1) a green-economy economic orientation, focusing on reducing environmental risks, resource scarcities, and building a climate-resilient society; 2) a neoliberal economic orientation, prioritizing the marketization and commodification of the solution for the climate change crisis; 3) instrumental learning, positioning learning as an instrument to manage environmental resources and to solve environmental problems, as well as prioritizing scientific and technologically-based knowledge; 4) participatory learning, inviting the participants to be part of the solutions for climate change issues; 5) an ecologically-centered human-nature relationship, recognizing the connection between humans and natural systems, valuing the traditional knowledge, and contributing to a long-term sustainable relationship between humans and nature; and 6) a resourcist-approached human-nature relationship, viewing the environment as a pool of resources. A green-economy economic orientation is the most prevailing assumption in the content on the ACE elements, followed by a neoliberal economic orientation, as represented in the analyzed documents. Instrumental learning and a resourcist-approached relationship are more commonly included than assumptions of participatory learning and an ecologically-centered relationship. In what follows, I will describe the findings related to each of the above three research questions.

Inclusion of Various ACE Elements

All Annex I Parties showed a certain degree of engagement with the ACE elements, as they included some ACE element content in their NCs. Findings were identified to each of the six ACE element themes. I will describe the findings of these themes in the following.

Education. All 44 study documents included content on the ACE element of education in their country submissions, making education the ACE element reported by the most significant number of countries. Categorizing all references (508) to the ACE element of education by the target audience, tertiary education has the most considerable proportion of reported education activities (200 references), followed by secondary education (140 references) and primary education (99 references). Overall, the study documents indicated that the ACE element of

education was undertaken in many Annex I Parties in formal education through primary to tertiary levels. Curriculum integration and teacher training were the two main focuses in the references to education, while the references in relation to extra-curriculum including various activities, such as educational projects organized in schools by multiple actors. However, the situation varied at different levels of education. In tertiary education institutions, the data suggested that the ACE element of education was conducted primarily through degree programmes and courses in formal education. In contrast, both curriculum and extra-curriculum learning were popular in the schools at the secondary and primary levels. I will provide a more detailed description and examples of the findings in the following paragraphs.

All 33 countries reporting the ACE element of education in tertiary education reported climate change content as degree programmes or courses. Some of these programmes focused on climate literacy to improve students' understanding of climate change's causes, economics, and impacts, and mitigation against and adaptation to it (e.g., in Canadian and Danish NCs) (e.g., in Canadian and Danish NCs). Other programmes emphasized specialized areas of climate change study such as renewable energy, sustainable development, and resource management[2]. A few countries provided abundant examples of climate-focused university programmes in their reports, such as in the NCs of Denmark, Italy, Lithuania, and the US, emphasizing the academic learning aspect of climate science and climate change issues. Apart from that, several Annex I Parties' NCs also focused on training future professionals, including preparing future teachers with climate change mindsets and skillsets through Master's and doctoral programmes. For example, Australia's NC stated that "the domestic and international workforce and researchers are equipped with the expertise to manage climate change" when courses with climate change content were provided in tertiary education (Australian NC, p. 181). Canadian NC claimed that enhanced climate research through partnerships between government scientists and academia helped equip "the next generation of Canadian scientists and researchers" (p. 294). Some countries' reports revealed that tertiary education for future teachers included discussions on climate content to some extent (e.g., in American, Belgian, Finnish, and Turkish NCs). The gap between the need for teachers with climate change-associated pedagogical expertise and the reality in terms of teacher preparedness was reported in Finland's NC. To narrow this gap,

[2] In Belarus, Cypriote, Hungarian, Icelandic, and Liechtensteiner NCs.

Finland has reported directing funds and resources for CCE towards teacher education, "[t]he Finnish National Agency for Education also
funds and organises in-service training for teachers on sustainable development for EUR 700,000 (2014 to 2016)" (Finnish NC, p. 275).

Data analysis also suggested that the ACE element of education was reported as extra educational programmes within tertiary education in the NCs[3]. These programmes targeted tertiary education, took place in the tertiary education institutions' premises, were organized by various actors, such as government, NGOs, and educational institutions, but were not included in the degree programmes or courses. For example, the government agencies organized a presentation or meeting addressing climate change-related topics to university students (Cypriote and Italian NCs). Or an art competition with an energy theme was organized for students by the universities (Kazakh NC). And environmental projects related to climate change were launched in the university by government agencies or NGOs (Romanian and Spanish NCs). Or an exhibition about "sustainable development at universities" was prepared by the university (Polish NC). However, compared with the degree programmes or courses reported in tertiary education, this type of educational programme only represented a small proportion of the references in the ACE element of education.

Formal education was reported as an essential channel for implementing the ACE element of education within secondary education. Still, extra-curriculum educational projects were reported as popular ways to promote ACE activities in schools. A total of 28 countries reported the ACE element of education at the secondary level, with 22 countries including references to curriculum education and 17 countries including references to extra-curriculum education.

Curriculum integration was the focus of the coded content to the ACE element of education at the secondary level. Several countries reported that including climate change in the curriculum could help reduce the impact of climate change. For example, Sweden's country submission addressed: "The National Swedish Agency for Education has clarified the connection between curriculum and syllabus and the national environmental goal reduced climate impact" (Swedish NC, p. 123). The ACE element of education was stipulated in the secondary education curriculum in some Annex I Parties, including the national curricula in Slovenia and Switzerland

[3] In American, Cypriote, Greek, Italian, Kazakh, Polish, Romanian, Spanish, Turkish NCs.

as reported in their NCs. Nonetheless, the ACE content has not gained an independent position in education yet. Instead, ACE appeared as multi-curricular or cross-curricular content and was often integrated into existing subjects, such as science, geography, biology, physics, and chemistry[4]. The UK reported introducing climate change as an explicit topic in the social studies curriculum. It has built a step-by-step learning path for students, starting from late primary or early secondary education (British NC, p. 267). The US was another country that reported a clear vision to "build in the next generation a foundation of knowledge and discourse as the nation faces decisions on how to best deal with a changing climate" (American NC, p. 233). The US reported that the training for a future generation with climate change in mind started as early as kindergarten to grade 12 education in the States. Portugal was the only other country that reported on CCE as an independent theme in the curriculum, being listed among different cross-cutting themes, as described in their country submission:

> The Framework proposes eight cross-cutting themes for all cycles and levels of education, consisting of subthemes and objectives and using descriptors appropriate to the education level involved, namely: sustainability, ethics and citizenship; sustainable production and consumption; territory and landscape; climate change; biodiversity; energy; water; land. (Portuguese NC, p. 159)

Moreover, in the countries that had already introduced EE and ESD in formal education, ACE was often attached to existing EE/ESD programmes (e.g., Cypriote, Kazakh, Latvian, and Slovak NCs).

Furthermore, energy education was reported as an essential aspect of ACE and included in the curriculum in a few NCs. For instance, American NC has translated ACE directly into energy education. Education at all levels in the US was reported having the specific goal of "ensure[ing] the ongoing development of a workforce to invent and scale up clean energy and energy efficiency technologies and processes over the long term" (American NC, p. 237). As for the vocational type of secondary education, climate change was covered in specialized vocational training focusing on renewable energy and the environment (e.g., in Greek and Portuguese NCs).

Teacher training was the other primary focus of the content to the ACE element of education at the secondary level. The documents indicated that educational resources with

[4] For example, in British, Canadian, Croatian, Estonian, Kazakh, Slovenian, Spanish, and Swiss NCs.

climate change content were widely available in line with school subjects, and teacher training was provided. Many Annex I Parties reported that they offered training opportunities to teachers to equip them with the knowledge and tools needed to incorporate climate change into pedagogy. Resources, such as training courses and teaching instructions, provided teaching tools and strengthened teachers' competencies. The teacher training opportunities not only benefited teachers but also spread the impact of ACE to the broader student community through the process of teaching and learning, as was stated in the US's report: "more than 100,000 teachers have received training and instructional resources, which have benefited millions of students" (American NC, p. 243). Several countries also reported that supplementary educational materials for teachers and schools were widely available online, supporting school education and making self-learning accessible.

Not only was curriculum learning reported in the NCs as essential to the implementation of ACE in secondary education, but extra-curriculum education was also identified in the NCs as a necessary aspect of ACE. Climate change-themed projects were commonly reported in NCs, such as the "Bike2school challenge" (Belgian NC), "Energie-und klimapioniere" (energy and pioneers) (Swiss NC), "Energy clubs" (Turkish NC), and "America's home energy education challenge" (American NC). These programmes provided valuable learning experiences to students even though they existed outside of the curriculum study. Some countries even reported their preference to implement ACE mainly through extra-curricular education. For instance, the Cypriote Ministry of Education and Culture systematically approached ACE through extra-curriculum study within a network of environmental education centers, providing non-conventional learning experiences outside of classroom settings:

> The issue of climate change in terms of non-formal education is approached systematically through the Network of Environmental Education Centers of the Cyprus Ministry of Education and Culture, which operates as a complementary structure of schools, with the aim of bringing environmental issues into fields of environmental interest and of transferring the learning process in terms of the environmental issues beyond and outside the context of the classroom. (Cypriote NC, p. 204)

The thesis data suggested that the ACE element of education in primary schools was carried out through curriculum and extra-curriculum learning, with almost equal emphasis on each. Out of 28 countries reported on the ACE element of education at the primary education

level, 19 reported curriculum education, and 22 reported extra-curricular education. Noticeably, many of these educational programmes were reported taking place simultaneously in secondary schools, accounting for over half of the references in primary education. Several Annex I Parties[5] reported on integrating climate change into the primary school curriculum in science, geography, biology, and chemistry, similar to what was reported in secondary education. The exceptions were found in American and British NCs, where the former reported on the inclusion of climate change in social studies (British NC, p. 267), and the latter reported on the intention to develop a clean energy curriculum (American NC, p. 249).

Additionally, a few countries reported covering ACE in the national curriculum for primary education. For instance, the national geography curriculum for primary schools in Estonia included "a separate block of topics dedicated to climate" (Estonian NC, p. 222). In British and Slovenian NCs, ACE was reported to be included in the national curriculum for primary education.

As an integral part of the ACE of education at primary schools, extra-curriculum education was reported in the form of various educational projects in the study documents, such as an "energy-saving competition" in Cypriote NC, "national energy awareness week" in Finnish NC, and "Slovenia is reducing CO_2: good practices 2015" in Slovenian NC. These projects were mainly led by government agencies and NGOs and operated at primary schools. These school projects did not belong to any particular subject curriculum or structured study, but they were described as offering meaningful ACE learning experiences. Some of these projects even extended ACE's influence to a larger social context. For example, the "Bike2school" initiative in Belgium started with the school students and mobilized the wider community ranging from teachers and school directors to students' families (Belgian NC, p. 146).

The ACE programmes were reported to focus on locally or regionally relevant topics at the local and regional levels. By doing so, these programmes linked the more significant issue of climate change to the tangible, familiar scenarios of students' lives. The strategy was used in several country submissions under the UNFCCC; for example, Estonia reported that "participants learned how climate change has impacted Estonian coastal areas and thereby their daily life" (Estonian NC, p. 225). The US also reported that extra-curriculum education programmes "connect youths to the environment within their communities" (American NC, p.

[5] For example, in American, British, Croatian, Cypriote, Estonian, Greek, and Slovenian NCs.

248). The educational activities also utilized local human and intellectual resources for teaching and learning at the local and regional levels. For instance, Italy reported that high school students were provided the learning opportunities about climate change challenges and the tools to deal with them from local university professors (Italian NC, p. 312). Compared with education at the national level, local and regional approaches were reported as being more specific and personal in the study documents.

At the international level, two types of educational programmes were identified in the study documents. The first one was tertiary education programmes or scholarships that were open to international students, especially those from developing countries (e.g., Australian and Dutch NCs); the other type was the dual Master's programme or research projects through cooperation between universities in different countries (e.g., Danish NC). These programmes also belonged to the realm of international cooperation and will be further discussed in the analysis section on the ACE element of international cooperation.

Training. Thirty-four countries reported on the ACE element of training in their country submissions with 216 references. The reported training activities mainly took place at the national level. They appeared through a broad range of opportunities, from vocational and professional training programmes to systematically help professionals increase climate change-related competencies to informal training sessions or programmes that provided technical support and practical advice to the broader public. Vocational and professional training was commonly reported across Annex I Parties' NCs under the UNFCCC. This type of training, as described in Switzerland's report, was purposely designed "for experience[d] professionals working in areas of particular importance for climate change mitigation and adaptation" to "better take into account the risks and opportunities of climate change" during decision-making processes (Swiss NC, p. 246).

The study documents focused on reporting vocational or professional training programmes that increased three competencies for handling climate change-related issues better. The first focused competency was employee skills that directly dealt with climate change-related issues in various professions. For example, government personnel were reported to receive professional development opportunities to gain work-related knowledge on climate change adaptation, thereby strengthening their ability to integrate considerations on energy efficiency, conservation, and sustainability into their services and policies (e.g., American, Canadian,

Turkish NCs). Parks and resource management officials were reported to receive training on sustainable natural resources planning and management in the face of climate change threats (American NC). Public health practitioners were reported to receive training to deal with the health challenges associated with climate change (American NC). Training aiming to build a local community's capacity in dealing with climate change was reported to cover various climate leaders, including community representatives, volunteers, and Indigenous leaders (e.g., American and Luxembourgish NCs). Moreover, the US was the only country that reported on its training courses targeting Indigenous groups in addressing challenges to climate change: "87 people from 62 tribes or tribal organizations have been trained in developing adaptation plans to prepare for the expected impacts of climate change" (American NC, p. 266). In addition to the training for Indigenous groups domestically, the US also reported training for Indigenous leaders in tropical regions of Latin America and Asia from American organizations about conserving rainforest ecosystems (American NC, p. 259).

The second focused competency reported in the NCs was the skills required in the sectors related to the green economy, including construction, energy, agriculture, land use planning, and mobility. The professionals and skilled workers in these sectors were reported to receive training for technologies and skills that supported the transition to a green economy[6]. The third focused competency was skills to educate and communicate about climate change, which indirectly dealt with the climate change challenges. This type of training targeted educators by providing methods and materials for their educational activities and training for their communication skills. Poland and the United States included multiple examples of this type of training programme in their NCs, particularly addressing training for informal educators such as forestry educators (Polish NC), park educators (American NC), and government staff in charge of public education (American NC).

Additionally, some countries reported on training programmes that focused less on the participants' professional background, instead, targeting a broader range of audiences. This kind of training programme was aimed at strengthening the participants' general and practical skills concerning dealing with climate change. Energy efficiency and programmes that provided advice on energy saving were a big theme for this type of training, as reported by several countries, including American, British, Canadian, Kazakh, and Swedish NCs. Other themes of the reported

[6] For example, in American, French, German, Hungarian, Italian, Luxembourgish, Slovenian, and Swiss NCs.

training programmes included climate-friendly technologies and services (Austrian NC), climate change science (Swedish NC), green careers (American NC), and technical training on renewable energy infrastructure (American NC).

Public awareness. The ACE element of public awareness was the most reported ACE element, accounting for nearly half (46%) of all coded content concerning all the ACE elements. At the national level, "climate science literacy" (American NC, p. 244) was a big part of the public awareness programmes reported in the study documents. These programmes employed communication channels varying from one single information portal to abundant and diversified programmes promoting climate change information in general. In the study documents, some countries, such as the US, could expand the public's scientific knowledge on a large scale through public awareness activities, building on their research and technology achievement, well-established public education infrastructure, and close collaboration between federal government agencies.

Other than climate science literacy or general information on climate change, the main focus of reported public awareness activities was associated with the green economy. These topics related to a green economy ranged from energy and mobility to farming, and low-carbon society, across all geographic levels, with the majority focusing on the national level. Almost all 39 countries reported on the ACE element of public awareness reported on one or more themes about a green economy in their NCs. Energy efficiency was the most prevalent reported topic and was found to be the sole topic in some countries' NCs, such as Germany and Greece. European countries commonly reported on the theme "low-carbon society" or similar terms, including "carbon neutral municipalities" (Finland NC), "sustainable zero carbon ECOTown" (Lithuanian NC), "transition to a green…economy" (Dutch NC), "fossil free society" (Swedish NC), or "green growth" (Turkish NC). Canada reported on a series of roundtables and workshops organized by the government that contributed to a Canadian definition of "low carbon energy future" (Canadian NC, p. 300), becoming the only country outside the European region that reported a "low-carbon society" theme in public awareness activities. The reported actions seemed more urgent for the countries that faced a direct threat from climate change. For instance, as a country that faced flooding threats from rising sea levels, the Netherlands reported on projects that focused on promoting self-resilience through such means as water management at all three geographic levels.

The reported public awareness activities also commonly focused on the influence and publicity of the events in the NCs. All the public awareness activities aimed to reach out to as many geographic locations and as many people as possible. In that sense, the general population's comprehensive inclusion was preferred to the depth of knowledge in the reported public awareness programmes. Therefore, it was typical to see symbolized activities such as "Earth Hour," "Mobility week," and "Bike to work day" being reported across country submissions. Despite the emphasis of these campaigns that involved a massive population, there was a lack of measurable records in the NCs in relation to these events. Only a few countries[7] reported the number of attendees (e.g., people, cities) and social media indicators (e.g., tweets, likes). For example, Switzerland reported on the media coverage for a campaign that reached "70 per[cent] of the Swiss population and 20 million kilowatt-hours of electricity were saved by persons implementing energy-saving measures" (Swiss NC, p. 246), providing a measurable outcome of that campaign. However, most of the Annex I Parties use undefined words in their NCs to describe the result of the public awareness events, such as "good participation" (Icelandic NC, p. 138).

Various means of communication were reported to spread the information to the vast majority of the public. Publications (books, reports, brochures), media (websites, social media), lectures and conferences, and exhibitions were identified in the reports. As a communication channel, both traditional media and social media were valuable and efficient communication methods to reach a large population, as indicated in the study documents. Estonia stated, "…the wider public are mainly informed on climate-related issues through the media" (Estonian NC, p. 228). Besides, the UK also reported: "social media has been used as a tool to generate wider awareness of the UK government's work on Clean Energy" (British NC, p. 271).

The references to the ACE element of public awareness targeted various audiences, as indicated in the study documents. Although, nearly half of the references to the ACE element of public awareness targeted the general public without clearly defining the target audience, which was generally described as "citizens," "individuals," "consumers," among others. Some clearly defined target audiences were reported as well. The most frequently reported target audiences were formal education from primary to tertiary education, followed by government and industry. Formal education was the biggest target audience for the ACE element of public awareness

[7] For example, in Austrian, British, Estonian, Italian, and Swiss NCs.

partially due to the activity overlap between the ACE elements of education and public awareness in the coding process. After formal education, the government was the second most frequently reported target audience. The content on public awareness targeting the government was mainly associated with the activities focused on providing advice, information, and tools to governments and authorities for climate change mitigation and adaptation. The most vulnerable industries in the face of the climate change crisis were also targeted in the references to the ACE element of public awareness, such as agriculture, forestry, or the housing and mobility industry. Other target audiences were NGOs and the scientific community.

Moreover, the US further reported on communication strategies for better climate change communication using audience segmentation, as "different audiences have different information gaps and misconceptions and want to know different things" (American NC, p. 234). They reported using such an audience-focused approach in various public communication portals, such as website designs (American NC, p. 234). The approaches concerning the scientific community were another excellent example of audience segmentation strategy. For instance, research projects (Danish NC) and journal articles (Russian and Slovak NCs) were reported as approaches to engage scientific communities, easily differentiated from the approaches to other target audiences.

Another reporting focus on the ACE element of public awareness was international drivers for national public awareness programmes. There were two critical international drivers for public awareness being reported: international conferences and international initiatives. First, influential international meetings provided opportunities to launch more awareness campaigns at the national level. For example, as Conference of the Parties (COP) 21 took place while the seventh NCs (this thesis' study documents) were being produced, several countries[8] reported on public awareness activities organized before, during, or immediately after the UN climate change conference COP 21. Second, public awareness activities resulting from international initiatives were commonly reported as simultaneously launched in several countries. This type of flagship project was prevalent among countries in the same geographic region, particularly in the European region. Examples were the "Covenant of Mayors" (e.g., Lithuanian and Spanish NCs), "European week of mobility" (e.g., in Austrian, Luxembourgish, Slovenian, Spanish, and Greek NCs), "Bike to work" (e.g., Icelandic, Latvian, and Luxembourgish NCs).

[8] For example, in Belgian, British, Cypriote, Dutch, Estonian, French, Icelandic, Italian, Maltese, and Spanish NCs.

Similar focuses and communication approaches to the ACE element of public awareness were reported at the local, regional, and international levels. Moreover, there were some specific themes at the local level worth acknowledging. First, at the local level, it was reported that activities focused on creating responses and actions to locally relevant information. Local municipal areas or communities became the focal point for public awareness activities to take place. Local communities and companies were provided with climate change information and tools, which were practical and had day-to-day life applications, leading to more concrete actions. For example, Italy reported in their NC: "The Bologna residents are called upon to make something concrete for their town through a certain number of suggested activities divided online into the following categories: agriculture, buildings, resilience, green space, water, mobility" (Italian NC, p. 333).

Public access to information. A significant proportion of countries (37/44 countries) reported on activities related to the ACE element of public access to information in the country submissions, most of which took place at the national level. Three main types of information were reported to the public through communication channels that were mainly managed by the governments, including general information, practical information, and labeling programmes. The governments provided general information that aimed to strengthen scientific understanding and up-to-date country conditions. This type of general information included data and statistics about measures of GHG emissions and climate change information concerning the causes and effects, mitigation and adaptation, government policies and actions, and related financial support, among other things. The second type of information was reported to introduce the best practices, guidance, and expert advice to the audience. For example, the "Green Vehicle Guide" in Australia provided consumer guidance for vehicle purchases. The energy performance tools for buildings designed by the Office of Energy Efficiency in Canada offered another example of this type of information. Similar examples of practical information were reported in many NCs[9]. The third type of information identified in the reports was various types of labeling programmes that regulated the producers and provided credible information to users at the same time.

Although all three types of public information were present in the study documents, the first one, general knowledge of climate change, was predominant and was included in all

[9] For example, in American, Australian, Belgian, Canadian, Luxembourgish, Zelanian, Norwegian, and Swedish NCs.

countries' NCs that had content on the ACE element of public access to information. I also found at the national level that governments, including national governments, unitary governments, and federal governments depending on the country's political system, were the main actors promoting public access to information. For countries with more capacity, it was noticeable in their reports that multiple ministries and departments communicated to the public climate change-related information in their respective fields of responsibility. Collectively, they wove a comprehensive web of information resources (e.g., American NC).

Moreover, industries and governments, especially local governments, were addressed as target audiences occasionally in the study documents. Vulnerability to climate change in some industry sectors led to special attention from the government. For example, the agriculture sector, forestry, construction, and automotive sectors were reported to be mainly in need of climate change mitigation and adaptation information (e.g., Belgian, Zelanian, Russian, and Swedish NCs). Specific information and communication channels were reported to be purposely set up for these industries.

Furthermore, the Internet has been reported as the main channel of communication of climate change-related information in 33 NCs[10]. Two countries, Iceland and Lithuania, particularly emphasized the efficiency of using social media for public access to information in their country submissions. Iceland NC reported that Facebook provided a low-cost and accessible communication channel, "[t]his has proven to be an important information channel, considered the limited financial resources of those institutions, as it is inexpensive, easily accessible and that the majority of Icelanders have a registered Facebook account" (Icelandic NC, p. 140).

Overall, it was suggested that the Annex I Parties were interested in making information, particularly the objective and science-based information, widely available for the public at the national level. The content on the ACE element of public access to information at the local and regional levels addressed similar types of information, with more focus on geographic relevance. Compared with the types of information that the public had access to, the target audience was not a significant aspect of this ACE element in the study documents. Climate change-related information, data, and statistics were meant for all public.

[10] Excepted for Cypriote, Italian, Japanese, and Liechtensteiner NCs, all NCs that reported on the ACE element of public access to information included the Internet as a communication channel.

Public participation. The ACE element of public participation was the least reported ACE element, only reported with 89 references by 28 countries. The activities related to public participation were mainly carried out with two main approaches: top-down and bottom-up participation. Many Annex I Parties reported on the initiatives of public participation launched by governments, who actively invited the general public in the process of legislation and created platforms to allow opinions to be expressed and collected. Facilitating public participation was often reported as an obligation of the governments (Greek NC, p. 371) and open to all public "regardless of their background" (Finnish NC, p. 279). In organizing public participation, governments demonstrated the transparency of public action and co-constructed the democracy with the public (French NC, p. 220). However, the participants invited for public participation that governments organized may not cover everyone in the society as indicated in the study documents. For instance, New Zealand's NC was the only one that reported on the involvement of Indigenous peoples in their public consultation process, through the statements such as "fifteen public meetings and hui with iwi and hapū"[11] and "[t]he Ministry for the Environment has a Strategic Relationship Agreement with the Pou Taiao Iwi Leaders Group (Pou Taiao ILG)" (Zelanian NC, pp. 312 - 313).

The government-led public participation activities usually took a top-down approach. However, some NCs reported on a bottom-up approach as well. Examples that the public actively initiated participation concerning climate change can be found in some countries' NCs. For example, "[t]he Finnish Friends of the Earth (Maan ystävät) ran a campaign called 'The Big Ask' (Polttava Kysymys) to push the Finnish Climate Act" (Finnish NC, p. 284). The initiative "Italian Youth Think Tank on Intergenerational Equity" was organized by NGOs and youths and was well received by the government of Italy (Italian NC, p. 333). As the outcome of this initiative, the political proposal for intergenerational equity called "Italian Youth Declaration on Intergenerational Equity" was submitted to Italy's Ministry of Environment and included in the Paris Agreement (Italian NC, p. 333). Such reported public participation actions indicated that public participation was a reciprocal interaction between the authorities and the public to some degree.

International cooperation. The content on the ACE element of international cooperation was not the focus of the Annex I Parties' NCs, accounting for less than one-tenth of total

[11] Iwi and hapū: Maori communities and groups gathering.

references to all the ACE elements. Nevertheless, 36 countries reported their involvement in the ACE element of international cooperation, reflecting their widely observable collaboration. Four main approaches to international collaboration were identified in the reports: international aid, exchange of experiences, collaboration on educational programmes, and international programmes. The first international cooperation approach was the international aid between developed countries and developing countries, with the former assisting the latter with training, resources, funding, and technologies. The second approach was the exchange of experiences between countries. The third one was collaboration on educational programmes with contributions from all countries involved. The last primary international cooperation approach was the international programmes operated simultaneously across countries. Each of these approaches was reported to have its focuses and benefits; I will outline them one by one.

International cooperation was essential to less developed countries as addressing climate change can be challenging due to imbalanced capacity or experience. The first international cooperation approach was reported to handle such an inequality specifically. In order to increase the ability to tackle climate change challenges in developing countries, developed countries reported regularly organize educational programmes, training, workshops, and research projects with their partner developing countries. The individual participants from the developing countries, such as students, educators, researchers, professionals, and government officials, were the immediate beneficiaries of such programmes. Nevertheless, in the long-term, they were anticipated to contribute to "the development outcomes of their country" (Australian NC, p. 190), which was the very purpose of such international cooperation. On the other hand, developed countries also provided support in funding and technology for the programmes initiated within developing countries, which were typically linked to combating climate change impacts. For example, Greece reported on such an international cooperation project that belonged to this category:

> Global Environment Facility (GEF): GEF is an independent financial mechanism, which provides developing countries with grants for programs aiming at the improvement of the environment globally and promotes sustainability to local communities. The vast majority of GEF's projects concern African countries. GEF's programs deal with 6 complicate environmental subjects: Biodiversity, Climate Change, International Waters, Land

> Degradation, Ozone Depletion and Persistent Organic Pollutants (POPs). (Greek NC, p. 410)

Other international aid included supporting developing countries in fulfilling their international duties, such as supporting developing countries in the implementation of Nationally Determined Contributions (NDC) (Belgian NC, p. 148), or helping developing countries understand the technical issues in the international climate change negotiations (Zelanian NC, p. 318). Both long-term and short-term help was much needed in the developing countries and was reported through the ACE element of international cooperation in the study documents.

The second approach to the ACE element of international cooperation was exchanging experiences between countries. Countries shared best practices through reciprocal visits, conferences, and meetings, among other efforts. Frequent and smooth information exchange on climate change topics benefited the cooperating partner countries and the broader communities. For instance, New Zealand has reported on the advantages of organizing such an international communication event as below:

> New Zealand has partnered with the World Farmers' Organisation in the delivery of an annual farmer study tour. The tour's purposes are: to raise awareness within the international farming community of the issue of greenhouse gases from agriculture; to provide a way for farmers to share experiences and to be informed; and to inform the global research agenda, in particular the work of the GRA. (Zelanian NC, p. 317)

The third approach to the ACE element of international cooperation in the study documents was collaboration on various educational projects between partner countries. This collaboration ranged from the university degree programmes established and operated between universities in different countries (e.g., Danish NC) to research projects between institutions and cooperative projects focusing on climate and energy solutions (e.g., American, Italian, and Luxembourgish NCs). This approach to international cooperation was built on participating countries' strengths and characteristics, bringing the capacity to a higher level for both parties. The last noticeable approach to international cooperation in the country submissions was the programmes organized by international organizations operated simultaneously across countries. This type of cooperation increased the influence of climate change communication by connecting countries through global networks. For example, Portugal reported on promoting climate change-related programmes by joining an international environmental education network:

> Young Reporters for the Environment (https://jra.abae.pt/plataforma/) is an international programme for environmental education developed by an international network of the Foundation for Environmental Education (FEE), which currently comprises 34 countries and it is promoted in Portugal by the ABAE. (Portuguese NC, p. 166)

Similarly, Iceland reported on its participation and coordination in the annual European Mobility Week (Icelandic NC, p. 141), and Switzerland joined "the Climathon"[12] to boost innovative ideas for local climate change challenges (Swiss NC, p. 249). More examples were found in the NCs of Iceland, New Zealand, Spain, and the US.

The most frequently reported target audience of the ACE element of international cooperation was formal education, especially tertiary education, and government. Regarding tertiary education, 11 countries reported international collaboration between universities, resulting in a series of degree programmes and overseas study opportunities. The cooperation between government officials, on the other hand, took place through international communication and discussions. Between these instances of bilateral or multilateral cooperation, the governments were reported to be interested in cooperating on specific topics, such as education activities (e.g., Polish NC), investment opportunities (e.g., Zelanian NC), and carbon management projects (e.g., Portuguese, Slovenian, and Zelanian NCs).

Summary. In conclusion, all Annex I Parties had some ACE element content in their NCs analyzed for this thesis study. According to the frequency of the references concerning each ACE element, the relative focus on the ACE elements in reports is sequenced, from most prevalent to least, as public awareness, education, public access to information, training, international cooperation, and public participation.

I analyzed the inclusion of the ACE elements in the NCs through content to all six ACE elements. First, for the ACE element of education, the study documents suggested that ACE was undertaken in many Annex I Parties in curriculum and extra-curriculum learning, from primary through tertiary levels. ACE was commonly reported in the country submissions to be integrated into formal education, including degree programmes or courses in tertiary education and curriculum study in secondary and primary education. Extra-curricular education, such as projects run by NGOs and governments, was also reported as a popular ACE form at secondary and primary levels. Second, the ACE element of training was reported to increase work-related

[12] Climathon: a global event taking place around the world.

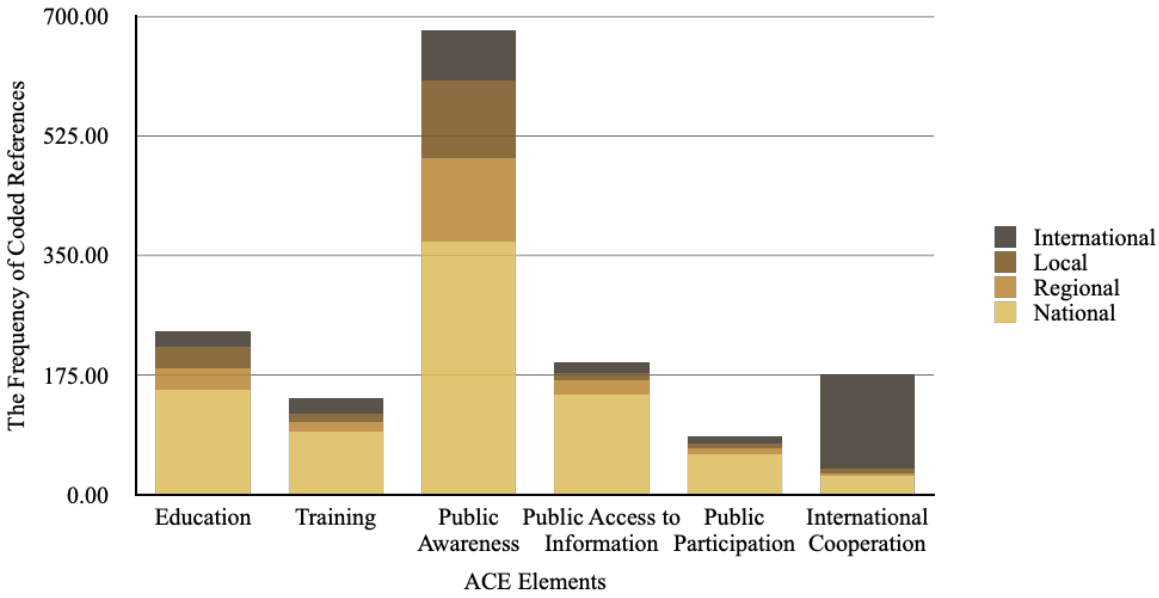
climate change competencies to professionals and provide practical advice on reducing the carbon footprint for the general public. Third, in terms of the emphases of the ACE element of public awareness, promoting climate science literacy was reported as the focus of public awareness activities, aiming to cover a wide range of audiences. Two international drivers that helped advocate public awareness initiatives were identified as international conferences and international initiatives, which amplified the influence of public awareness initiatives to an extent needed. Fourth, in terms of the types of information that the public has access to, three main types of information were identified in the reports: general information about climate change, practical information to adapt to and mitigate against climate change, and labeling programmes targeting both producers and consumers. Fifth, both top-down and bottom-up approaches were reported in the study documents in terms of public participation. Finally, four main approaches to international cooperation were commonly reported in the study documents, including developed countries assisting developing countries in raising climate change-related competencies, the exchange between countries of experiences of handling climate change, collaboration on ACE projects between countries, and ACE-related programmes spanning multiple countries organized by international organizations.

Geographic Trends

Among all 44 study documents, most of the Annex I Parties (38) were from the European region, followed by Australia, Japan, Kazakhstan, New Zealand from the Asia and Pacific region, and Canada and the US from the North American area. All Annex I Parties included some ACE element content in the study documents. The countries were divided into two groups by the number of the ACE elements discussed in their country submissions: one-three of the six ACE elements or four-six of the six ACE elements. This analysis showed that most countries (38) reported on four or more ACE elements, while few (6) reported three or fewer ACE elements in their NCs. Bulgaria only reported on one ACE element, education, with one reference. In contrast, the US had the most significant number of references and reported on all six ACE elements, with 257 references altogether.

Figure 4.1.

The Frequency of References to The ACE elements at Various Geographic Levels



Five ACE elements had a greater focus on the national level, including education, training, public awareness, public access to information, and public participation, while one ACE element of international cooperation, unsurprisingly, focused on the international level. Figure 1 provides a broad overview of the frequency of references from all countries for each ACE element across four geographic levels: international, national, regional, and local. In what follows, I will discuss the findings on geographic trends concerning each ACE element.

Education. The content to the ACE element of education was coded with 508 references from 42 NCs, with nearly half of the references identified with geographic levels and most being at the national level. Thirteen countries reported on activities related to the ACE element of education at the regional level, including state, provincial, or territorial programmes within a country. Regional governments typically organized these programmes, as reported by the countries characterized as federal states or with similar decentralized political systems (e.g., Australian, Canadian, Spanish NCs). In some countries where the responsibility for education lay in the hands of regional governments, the regional curriculum was reported to include CCE content (e.g., British and Swiss NCs). Few education activities (30 references from 10 countries) were reported locally, such as those focusing on education programmes at one school or schools in one specific city.

Public awareness. The ACE element of public awareness was reported by 42 countries, with 1035 references, and was the most represented ACE element in the study documents. Although not all the references to public awareness identified the geographic areas where the activities were conducted, around two-thirds of references to public awareness were identified geographically. The coded content to the ACE element of public awareness included 371 references related to the national level, accounting for half (54.6%) of all geographically defined content. There was also a sizeable number of references to public awareness covering other geographic groups: 121 (17.8%) at the regional level, including the state, provincial, or territorial level within a country; 114 (16.8%) at the local level, or the municipal level; and 74 (10.9%) at the international level.

Several factors could explain these findings on the geographic levels of public awareness content in the documents. First, public awareness programmes were often reported as being implemented simultaneously on multiple geographic levels. Twenty-one of the countries were reporting on public awareness activities that fell into one or more of the following categories: those supported by governments at multiple geographic levels (e.g., Austrian, Belgian, and Portuguese NCs), those that targeted specific regional issues and operated at the local levels (e.g., Australian, Belgian, and Dutch NCs), and others that were promoted by a central actor, such as the national government or a NGO's head office, but were implemented at more local scales. Second, the type of government systems affected the geographic focus on public awareness activities in the reports. Federal states such as Belgium, where public awareness activities were under regional governments' jurisdiction, mainly reported regional activities. Spain was another example with decentralized political power that reported activities largely at the regional level. For instance, in Belgium's NC, 44 references to the ACE element of public awareness were at the regional level, and 4 were at the national level, while Spain's NC included 16 regional and 11 national references to public awareness activities. However, this emphasis on regional activities was not evident in the NCs of some other federal states, such as Canada and the United States. Their reports barely covered regional public awareness activities unless regions were mentioned regarding programmes across multiple geographic levels.

International cooperation. The ACE element of international cooperation was reported to focus on the international level due to the nature of its activities, involving more than one country's participation. In the coded content to this ACE element, 138 geographically identified

references (78.4%) from 31 countries were oriented to the international level. International cooperation activities were reported at the national, regional, and local levels in the study documents. However, most of these activities were reported at multiple geographic levels, including the international level, indicating that international cooperation always focused on the international level. As one would expect, there was no such thing as "international cooperation" operating only at the national, regional, or local levels.

Other ACE elements. The ACE elements of training, public access to information, and public participation were also mainly reported at the national level in the study documents, including 60 references (69.8%) from 23 countries related to public participation, 147 references (75.8%) from 32 countries related to public access to information, and 93 references (66.0%) from 22 countries related to training. Reported activities at the national level accounted for over two-thirds of all content identified with geographic levels in all three ACE elements of training, public access to information, and public participation. Since the frequency of the references for these three ACE elements was reasonably low, the recorded content at geographic levels other than the national level was relatively insignificant. Moreover, the references at the regional level for training, public access to information, public participation were mainly identified in the reports from the countries characterized as federal states or similar political systems, which may explain why these NCs were more likely to focus on the regional activities.

Government and Other Actors' Roles

In this thesis study, actors referred to the institutions or organizations that led climate change-related educational activities and policies. Their roles included initiating, developing, implementing, financing, and supporting activities related to the ACE elements, including regarding policy. The thesis data indicated that governments at multiple levels played a predominant role in engaging all the ACE elements across Annex I Parties. Other prominent actors included educational institutions, NGOs, think tanks, and industry. The study documents also suggested that multiple actors often worked together to promote the ACE elements, both within government agencies and between government bodies and other organizations; one-tenth of all references with described actors belonged to such a situation. Though governments played a predominant role, the dynamics between all associated actors varied from one ACE element to another. In what follows, I will provide a more detailed analysis of different actors' roles in each ACE element.

Education. First, with regards to the ACE element of education, the most commonly reported actor was government. A total of 124 references (48%) to actors in relation to the ACE element of education had a government as the main actor across 33 countries. The data indicated that national government bodies, especially those dealing with the environment, education, and energy, were the leading departments to organize and implement the ACE activities in formal education. Australia and Spain were the only two countries that reported regional or local governments' efforts in the ACE element of education. National government departments oversaw implementing the ACE activities in many countries. The government-led educational efforts fell into three categories. First, the most common one was to organize educational activities directly for schools and students. Second, they provided training and assistance to teachers. Lastly, they approached the ACE element of education systematically through curriculum or education programmes. Apart from having a leading role in education, government bodies were also reported to play a supporting role in education programmes initiated by other institutions and organizations. For example, NGOs or industry associations partnered with government agencies in the United States to launch various educational programmes, receiving support such as data, statistics, and expertise from those agencies.

Educational institutions were another important actor in formal education, with 85 references (33%) to actors across 22 countries. Among the reported educational institutions, tertiary education was referenced the most (90.9% of referenced educational institution actors were tertiary institutions). These tertiary education institutions organized education programmes, ranging from university degree programmes and courses to teacher training programmes for pre-service and in-service teachers, to outreach activities for primary and secondary education (Belgian, Danish, and Italian NCs). Several countries reported ACE-related programmes offered by secondary educational institutions, particularly vocational schools, such as in the NCs of Austria, Estonia, Italy, and Kazakhstan.

NGOs were another fairly well-reported actor for the ACE element of education, mentioned in 17 countries' reports concerning education, with 37 references (14.3%). They were discussed as having essential roles for education initiatives, such as funding the programmes (German NC), proposing tenders for CCE programmes (Croatian NC), conducting programmes at schools (Canadian, Estonian, and Italian NCs), and supporting schools in participating in international programmes (Estonian NC).

Public awareness. Secondly, the government was also the most referenced actor in relation to the ACE element of public awareness with 468 references (67.1%) across 39 countries, followed by NGOs with 135 references (19.4%) across 32 countries, think tanks (6%), educational institutions (4.4%), and industry (3%); the above included 67 references (0.96%) that reported on more than one actor. Governments, especially national governments, were mentioned as initiating, leading, supporting, and financing public awareness activities. There was intensive cooperation reported within national ministries, between governments at different levels, and between governments and other organizations. At the national level, it was observed in several reports that the Ministry of Environment took the leading role in promoting public awareness activities, followed by ministry departments related to energy. Apart from that, a broad spectrum of ministries and government agencies were reported to take part in organizing and financing public awareness activities, including education (Cyprian and Danish NCs), business and economy (Dutch, Luxembourgish, Swedish, and Zenalian NCs), foreign affairs (Slovenia NC), infrastructure (Luxembourgish and Slovenian NCs), agriculture (Turkish NC), forest agency (Swedish NC), and transportation (American and Luxembourgish NCs), among others. Government agencies that dealt with air and space were also reported to lead public awareness activities. The examples included meteorological institutes in Danish, Icelandic, and Slovak NCs, the National Aeronautics and Space Administration (NASA) in American NC, and state-funded national parks in American, Icelandic, and Italian NCs, and museums in American NC.

Several countries reported that their governments' involvement in public awareness was at the regional and local levels[13]. For these countries, the regional governments in countries with different degrees of decentralized political power were reported as more important actors than the national government in driving public awareness activities. Such countries included federal states (e.g., Belgian and Canadian NCs), unitary states with devolution of certain powers (e.g., British NC), and states of autonomies (e.g., Spanish NC). For the countries reporting local governments' efforts in promoting public awareness activities, this was perhaps due to the realization of the importance of local governments in promoting climate change awareness, as suggested in Finnish NC: "the municipalities play a decisive role as intermediates of information regarding attitudes towards climate issues and effecting changes in people's lifestyles" (Finnish

[13] In Belgian, British, Canadian, Estonian, Finnish, Greek, Icelandic, Italian, Luxembourgish, Romanian, Spanish, Swedish, and Turkish NCs.

NC, p. 282). It may also be easier to bring people together towards a common goal in a smaller geographic area, evident in the NCs of Finland and the Netherlands. The latter reported: "The transition to structural sustainable energy use and supply must above all be achieved at the local level" (Dutch NC, p. 205).

Apart from the active role of various levels of government in leading public awareness, another significant finding was the interwoven web of collaboration within government agencies and between government bodies and other organizations with regard to public awareness activities. Several countries reported government ministries and agencies working together to promote public awareness within government agencies. Noticeably in the United States' report, multiple government agencies were reported as often working together on one public awareness initiative to take full advantage of all involved parties' expertise (American NC, p. 240). A wide range of organizations, particularly NGOs, were involved in such collaborations as reported in the NCs.

NGOs, or civil society, were the second biggest actors in leading public awareness initiatives, as reported by 32 countries with 135 references to the ACE element of public awareness. Environmentally oriented NGOs took the lead in this category, followed by NGOs with sustainable development and environmental justice focuses. Building a coalition with other organizations, including government agencies and other NGOs, was a typical NGO operation. Such cooperation amplified the impact of public awareness activities (Polish NC, p. 229). In some countries, influential NGOs dominated attention in the country's reports; for example, Size of Wales was the only NGO mentioned as carrying out climate change-related public awareness activities in the UK's report.

Think tanks, educational institutions, and industry were also reported to raise public awareness of climate change. Most of the think tanks reported in the study documents were administrated by governments[14]. A few countries also reported on independent research institutions' involvement, including Finnish, Spanish, Swedish, Swiss, and Zelanian NCs. The research institutions focused on providing information, journal articles, and other research-based activities within their research fields. Educational institutions mostly referred to tertiary education institutions or related associations in the study documents. Their public awareness activities ranged from organizing conferences, lectures or exhibitions, to launching information

[14] For example, in American, Australian, Croatian, Zelanian, Russian, and Swedish NCs.

portals and publishing articles and books. Notably, the industries that were most involved with creating GHG emissions, such as farming industries (Irish and Luxembourgish NCs), the aviation industries (Russian and Turkish NCs), and the construction and transportation industries (in Switzerland NC), were reported as having an active role in organizing public awareness activities.

Public access to information. Third, for the ACE element of public access to information, the government still represented the predominant actor in the study documents, accounting for 176 references (74.9%) to public access to information in 36 countries' NCs. Government references included ministries and agencies responsible for various fields, not only having the ones in charge of environment or climate change affairs but also others such as health, transportation, construction, and foreign affairs, among others. Additionally, Spain reported on the government's involvement, particularly at the regional level, which was in line with their autonomous communities' model of government structure. Moreover, the governments' leading role manifested through either direct involvement or commissioned jobs in the study documents. For instance, Australian NC reported that the federal government commissioned "a comprehensive review of the state of the Australian environment every five years" (Australian NC, p. 185).

The other prominent actors reported in the ACE element of public access to information were think tanks, reported by 10 countries with 29 references (12.3%). Think tanks were reported to provide access to unique information to the public. They were reported as providing research-based climate change information to the public through published articles in academic journals, demonstrating academic credibility in the information provided; as well as reports and newsletters through the Internet, reaching out to lay audiences. Collaboration between think tanks and governments was observed in some countries' NCs. For example, Finish NC reported, "the steering group[15] publish[ed] an online magazine 'Klimaatti' focusing on analytical feature

[15] The Steering group for Climate Communications consists of all relevant ministries (the Ministry of Agriculture and Forestry, the Ministry of the Environment, the Ministry of Economic Affairs and Employment, the Ministry for Foreign Affairs, the Prime Minister's Office Finland), research organisations (the Finnish Environment Institute (SYKE), the Finnish Meteorological Institute (FMI), VTT Technical Research Centre of Finland Ltd, Natural Resources Institute of Finland (Luke)), regionally operating organisations (Centre for Economic Development, Transport and the Environment and the Association of Finnish Local and Regional Authorities), Tekes – the Finnish Funding Agency for Innovation, Sitra the Finnish Innovation Fund, Motiva Ltd (see Section 9.4.2), and the think tank Demos Helsinki. (Finnish NC, p. 279)

articles providing concrete solutions for climate change mitigation and adaptation" (Finish NC, p. 279). Similar examples can be found in the NCs of Denmark and Monaco.

International cooperation. The main actor reported in relation to the ACE element of international cooperation was the government, accounting for 93 references (93%) across 32 countries. The study documents suggested that as country representatives, governments played a crucial role in initiating projects related to the ACE elements and implementing them multilaterally with other nations. National governments were reported as communicating with their foreign counterparts and establishing cooperation at the international level. Internally, it was discussed that national governments could utilize their resources to support these initiatives. However, some unique patterns for international cooperation appeared in the study documents. For example, there was close cooperation between countries with historical ties and traditional relationships, such as Australia and countries in the Indo-Pacific region; New Zealand and Pacific Islands; France and francophone countries; Portugal and Portuguese-speaking countries; and countries in the Nordic area. In Europe, the European Commission worked closely with European Union member states and collaborated on several international cooperative projects.

Other ACE elements. Finally, the ACE elements of training and public participation reported the government as the leading actor in their country submissions. In terms of training, governments organized, financed, and provided training directly and indirectly through cooperating with and supporting other organizations that offered training programmes. As for the ACE element of public participation, governments consulted the public in the legislative process of climate change-related policies. In line with governments' consultation procedures, NGOs' efforts in organizing discussions with the public and voicing their concerns to governmental bodies were also reported by some countries[16].

The Relative Focus of Learning Dimensions

The analysis also examined the relative focus of cognitive, behavioral, and socio-emotional learning dimensions in references to the ACE elements in the study documents. The data suggested that cognitive learning was more commonly reported than behavioral or socio-emotional learning dimensions in relation to the ACE elements. The socio-emotional learning

[16] In Croatian, Estonian, Finnish, Italian, and Maltese NCs.

dimension was the most under-addressed one in the NCs[17]. The country submissions reported more on the ACE activities that strengthened learners' knowledge and thinking skills that help understand climate change better. This finding corresponded with UNESCO's (2019) CCE monitoring project results, which suggested that the cognitive learning dimension was commonly reported in formal education across country submissions under the UNFCCC, including both Annex I and non-Annex I countries (p. 7).

Regarding any variations across specific ACE elements, education and public awareness addressed behavioral and socio-emotional learning dimensions, with respective emphasis on action competencies and social skills. However, this was less common than a focus on the cognitive learning dimension. The ACE elements of training and public access to information included little content related to behavioral and socio-emotional learning dimensions. Moreover, there was limited content (fewer than ten references in total) on learning dimensions in relation to the ACE elements of public participation and international cooperation. Therefore, my more in-depth analysis only focuses on learning dimension content regarding the ACE elements of education, training, public awareness, and public access to information.

Education. In terms of references to the ACE element of education, various learning experiences were reported in formal education. The cognitive learning dimension was the most reported, with 109 references (61.9%) across 22 NCs. Providing the concept knowledge to understand climate change was the focus of the curriculum and extra-curriculum education at schools, such as environmental education programmes carried out by NGOs or government agencies. Through these activities, "key concepts about the problem of climate change" (Italian NC) and "climate change literacy" (American NC) were promoted.

However, many of these programmes did not intend to bring learning to the action level. There was no articulation of whether the learning would also extend to the action level in most cases. Exceptions included 51 references (28.9%) from 23 NCs, which addressed the behavioral learning dimension to improve the learners' action competencies. The primary approach to address this learning dimension in education was by involving participants to be part of the solution for climate change issues, usually accompanied by descriptions such as "how we can

[17] Socio-emotional learning dimension was identified with 21 references to the ACE element of education, 2 references to training, 52 references to public awareness, 4 references to public access to information, 2 references to public participation, and 7 references to international cooperation.

make" or "how to make a change." Programmes reported were open to new ideas and aimed to inspire the learners to seek innovative ways to tackle climate change issues. Examples included an energy conservation competition organized among schools in Germany with the prizes going to the most innovative, creative, and efficient climate action projects (German NC); environmental decision-making process and community actions involved students in Malta (Maltese NC). Another approach reported to address the behavioral learning dimension was to promote behavioral and consumption habit change. For example, Belgium NC reported on an energy consumption contest, "GénérationZéro-Watt," that encouraged behavioral and consumption changes among pupils (Belgian NC, p. 144).

Apart from the relative focus on reporting cognitive and behavioral learning dimensions, a few countries also reported on the socio-emotional learning dimension (21 references, 11.9%, from 16 NCs) in the content to the ACE element of education. For example, the Croatia Education and Teacher Training Agency listed the socio-emotional learning dimension as one of the necessary competencies for sustainable development (Croatian NC, p. 187).

Public awareness. While examining the content on the ACE element of public awareness in the study documents, cognitive and behavioral learning dimensions were reported in 36 and 35 country submissions, respectively, with 401 (66.9%) and 150 (25%) references. There were 21 NCs that included content associated with the socio-emotional learning dimension concerning public awareness, with 52 total references (8.7%). The cognitive learning dimension was reported to be the focus of the ACE element of public awareness, often associated with "better understanding," "raising awareness," or "providing information" in the NCs, indicating the general reporting focus of public awareness was how it could provide information and help the audience gain knowledge of climate change and related issues.

Some of the study documents reported public awareness focused on delivering cognitive information and advocating for actions. Three main types of action-oriented public awareness activities were identified in the reports. The first type of action-oriented public awareness activity was recommendations or information that led to actions, focusing on delivering information that prompted the participants' actions. For example, a website containing a list of measures that participants can implement to reduce GHG emissions (Belgian NC, p. 133). The second type of action-oriented public awareness activity was a certificate programme that set standards for participants' necessary actions. For instance, multiple certificate programmes were

reported in New Zealand's NC that encouraged participating individuals and companies to take steps and meet the standards (New Zealand NC). The third type of action-oriented public awareness activity included campaigns requiring actions. For example, in the study documents, programmes called for consumer behavior change in housing, energy consumption, transportation (e.g., Belgian and Croatian NCs), or habit change in mobility and driving (e.g., Estonian and Polish NCs).

The references related to the socio-emotional learning dimension were relatively fewer in relation to the ACE element of public awareness than the other two learning dimensions. Nevertheless, the findings suggested that three main approaches to the socio-emotional learning dimension were reported in the content to public awareness. Building cooperation between participants was the primary approach. Many programmes were reported to improve participants' socio-emotional aspects by providing learning opportunities for collaboration and skills for negotiation and communication. Building a connection between participants and climate change-related issues was another reported approach to the socio-emotional learning dimension. The participants realized climate change was an integral part of global issues regardless of geographic areas or demographic groups. This approach discussed and explored topics such as solidarity, social and environmental justice, and energy equality. For example, Estonia reported on a programme that discussed climate change issues associated with social topics, such as environmental justice and climate refugees, food products production, and consumption in Estonia (Estonian NC, p. 224). Such a programme connected participants to the issues outside their daily lives. The third reported approach to the socio-emotional learning dimension was generating attitude change from within the participants. It encouraged the self-reflection and shifting of attitudes and values, enabling the participants' self-growth. Examples can be found in several countries' NCs, such as a programme in Spain that encouraged the reflection on the responsible and efficient use of energy resources (Spanish NC, p. 202); as well as the Swedish municipalities' role in dispersing information "regarding attitudes towards climate issues and effecting changes in people's lifestyles" (Swedish NC, p. 292).

Other ACE elements. For the references to the ACE elements of training and public access to information, the cognitive learning dimension was the most reported compared to the other two learning dimensions. Out of 216 references to the ACE element of training, only 17 (7.9%) were identified with the cognitive learning dimension, 16 (7.4%) were behavioral, and 2

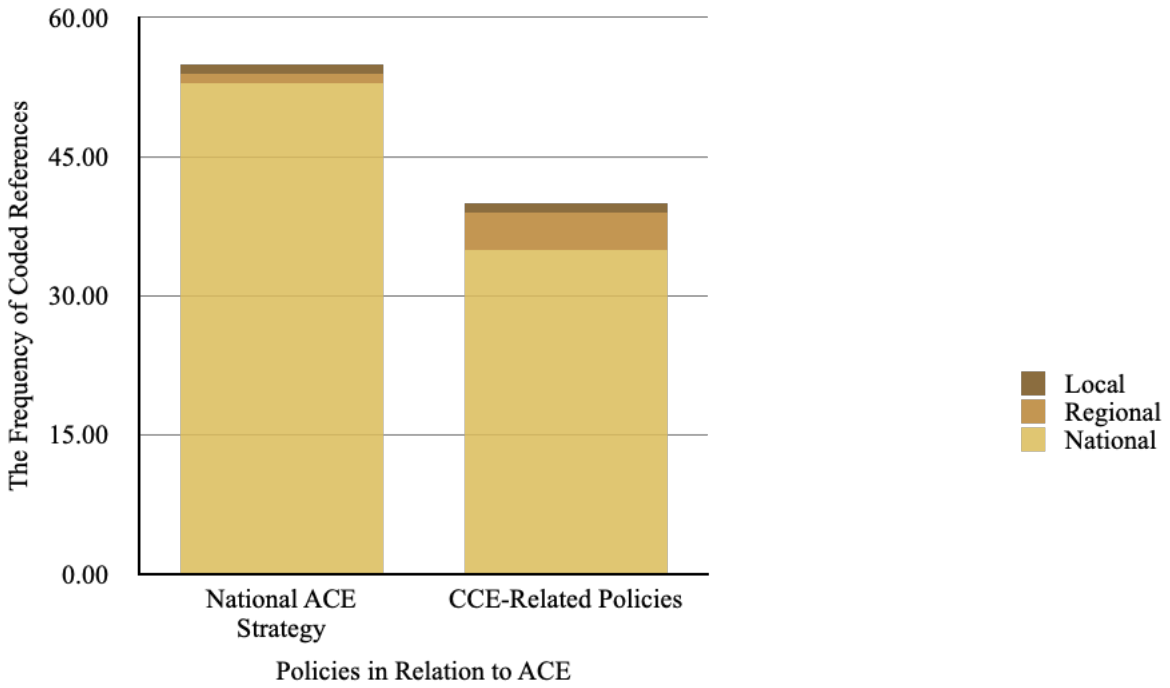
(0.9%) were socio-emotional. On the other hand, the cognitive learning dimension was identified with 72 references (88.9%) to public access to information in 20 NCs. The behavioral and socio-emotional learning dimensions were rarely reported in the content to public access to information, including 11 references (13.6%, in 8 NCs) identified with behavioral, and 4 references (4.9%, in 4 NCs) identified with the socio-emotional learning dimension. An example of public access to information with a focus on both cognitive and behavioral learning dimensions can be a website with climate change information designed for kids to "get informed, get involved, play and learn about climate change on an interactive, user-friendly platform" (Canadian NC, p. 296). Overall, learning dimensions were far less reported concerning these two ACE elements than the ACE elements of education and public awareness.

Annex I Parties' Engagement with Policies in Relation to ACE as Reported in the NCs

Policies related to CCE/ACE were reported in 27 countries' NCs. The references to policies included references coded to "national ACE strategy" and "CCE-related policies," providing data for analyzing the Annex I Parties' engagement with policies in relation to ACE as reported in the NCs. Figure 2 illustrates the frequency of references to ACE in relation to policy, which was almost exclusively at the national level. Respective policies addressed the ACE elements of education, public awareness, public access to information, and the ACE elements in general (included more than two ACE elements). The policies were only discussed concerning the ACE elements of training, public participation, and international cooperation were absent in the study documents.

Figure 4.2.

The Frequency of References to Policies in Relation to ACE at Various Geographic Levels



Moreover, I identified three main policy types in content referring to the ACE elements, including national curriculum frameworks, national legislation and laws, and national strategic plans. Additionally, some policy documents reported in the study documents did not belong to the above three defined policy types and were categorized as "others," including policy documents such as government guidelines and action plans. In what follows, I will specify the findings of policies in relation to the ACE elements, particularly to the ACE elements of education and public access to information and the ACE elements in general.

Regarding policies' relative focus on the geographic levels, it was identified that policies in relation to ACE were reported mainly at the national level with few exceptions. For example, a regional climate change strategy with an educational component in Spain (Spanish NC, p. 213) and a local climate strategy for Hungary's capital city (Hungarian NC, p. 213). The main actor to enact and implement policies in relation to ACE was the government, which made sense as government authorities prepared and issued policy documents in most cases. However, Lithuania reported that NGOs participated in preparing a national climate change strategy in their country submission (Lithuanian NC, p. 217), shedding light on actors other than the government.

Education. The ACE element of education was the main ACE element mentioned concerning policies, which appeared in all four categories of policy in relation to ACE in 22 countries' NCs. ACE-related content was reported to be incorporated into the national curriculum frameworks in many countries. However, the emphasis of ACE in the national curriculum frameworks differed from country to country, based on the national context. Climate change content was commonly reported as a sustainability theme in the countries with EE/ESD in the curriculum structure[18]. In some other cases, national curriculum frameworks were reported to include ACE within various subjects, namely science, geography, and biology[19]. Switzerland reported on addressing climate change explicitly in the national curriculum for lower secondary education (Swiss NC, p. 239). Apart from reporting ACE in national curriculum frameworks, as a federal state, Switzerland's NC also reported integrating climate change content into regional curricula (Swiss NC, p. 239).

National legislation and laws were another way to legitimate ACE in formal education. Some of these laws were education-specific, addressing education's scope and structure. Such an approach was reported in four country submissions (Czech, French, Italian, and Polish NCs). However, not all of the laws or Acts that provided legal grounds for ACE were education-specific. For example, France reported on the enactment of "the Energy Transition for Green Growth Act," aiming to reach "energy transition and combating climate change" by placing ACE at the center of this Act (French NC, p. 217). A few countries also reported on ACE being included in national strategic plans, including a "strategy for education for sustainable development" in Czech NC, a "national strategy on sustainable development" in Italian NC, a "national strategy for environmental education" in Portuguese NC, and a "national strategy for global education" in Slovak NC. Some policies in relation to ACE were reported as guidelines and action plans issued by the government. For example, a circular that addressed EE's special issues included climate change in Greek NC, a guideline for EE and ESD that contained climate change-related material for teachers in Italian NC, and a list of priority knowledge areas announced by the government included climate change content in Kazakhstan's NC.

Public awareness. Policies mentioned in relation to the ACE element of public awareness were comprised of national strategic plans and other policy documents. However, not

[18] For example, in Cypriote, French, Hungarian, Icelandic, Maltese, and Portuguese NCs.
[19] For example, in British, Croatian, Finnish, Greek, and Slovenian NCs.

many NCs reported on policies related to the ACE element of public awareness. Only three countries (Hungarian, Polish, and Spanish NCs) reported on policies with a public awareness focus, and one government (Lithuanian NC) reported on a strategic plan for public awareness that was still in the pipeline.

Public access to information. The ACE element of public access to information was the second most addressed ACE element in the policies in relation to ACE across Annex I Parties. Three policy categories were identified to address the ACE element of public access to information in the study documents, including national legislation and laws, national strategic plans, and "others" policy documents. Laws and Acts were reported to regulate the rights for the public's access to information concerning climate change. For instance, Cypriote, Greek, Polish, Slovak, and Zelanian NCs reported national laws that guaranteed public access to environmental information, including climate change information. To that extent, British NC reported on a Climate Change Act that explicitly addressed the collection, storage, and dissemination of climate change information (British NC, p. 271). Only one example was identified in the study documents regarding national strategic plans: Finnish NC reported having national energy and climate strategy that specified public access to climate change and energy information and policy (Finnish NC, p. 271). In terms of other policy documents that specified the ACE element of public access to information, Greek NC reported on a circular issued to ensure public access to information.

ACE elements in general. Another finding in Annex I Parties' engagement with policies in relation to ACE was that policies did not always address the ACE elements individually. Instead, the policies in relation to ACE addressed two or more ACE elements, including national legislation and laws, national strategic plans, and others. In their country submissions, some countries reported on policies that targeted multiple ACE elements simultaneously, particularly in their national strategic plans and other forms of policies. For example, Latvia's environmental policy strategy "pa[id] special attention to education, training and awareness issues" (Latvian NC, p. 199), addressing issues related to three ACE elements of education, training, and public awareness. The "national strategy for climate change management policy for 2013-2050" in Lithuania (Lithuanian NC, p. 200) was associated with the ACE elements of education and public awareness. Moreover, national strategic plans addressing the ACE elements had a broad focus, varying from the environment to climate change management and EE/ESD to ACE.

Examples of policies with wide ranges of stress were: the "environmental policy strategy" (Latvian NC), the "national strategy for climate change management policy" and the "national strategy for sustainable development" (Lithuanian NC), the "national strategy for environmental education" and the "national strategy for adaptation to climate change" (Polish NC), the "national climate change strategy" (Turkish NC), and the "national climate change education communication strategy" (American NC), among others. Notably, out of all the reported national strategies that included ACE content, only American NC reported on a CCE-specific national strategy. Moreover, several other forms of government policy and action plans that addressed the ACE elements in general were also reported in the study documents, including environmental plans in the Czech NC, climate change policy plans in Finnish NC, and action plans on climate change in Romanian and Turkish NCs.

Summary. In conclusion, it was evident that policies in relation to ACE were less commonly reported in the Annex I Parties' NCs than the reported content on the ACE elements. The reported policies in relation to ACE included three main types of policy documents: national curriculum frameworks, national legislation and laws, and national strategic plans. Additionally, some policy documents reported in the study documents did not belong to the above three focused policy types but still gave policy grounds to ACE, including government guidelines, government circulars, action plans, among other things. Several policy documents addressed the ACE elements of education, public awareness, and public access to information specifically and the ACE elements in general, with education being the most addressed ACE element in ACE-related policies. However, no reported policies were designated to the other three ACE elements: training, public participation, and international cooperation. The policies related to ACE were incorporated into policy documents focusing on various areas, ranging from education, sustainable development to environmental protection and climate change responses. ACE was stressed as an indispensable part of the solution in the context of tackling climate change. Therefore, it was widely considered in policies for various areas in the study documents.

Assumptions Embedded in the Reported Practices and Policies in Relation to ACE

Across all the ACE elements, a green-economy economic orientation was the most commonly identified assumption, accounting for 576 references to the ACE elements, followed by a neoliberal economic orientation (178 references), instrumental learning (119 references), and participatory learning (89 references). A resourcist human-nature relationship was relatively

less identified in the references to the ACE elements, accounting for 40 references. An ecologically centered human-nature relationship was the least identified assumption with only six references to the ACE elements. In what follows, I will explain the findings in further detail in breaking them down into individual ACE elements.

Education. Regarding the assumptions embedded in the ACE element of education, a green-economy economic orientation, a neoliberal economic orientation, instrumental learning, participatory learning, and a resourcist human nature relationship were all identified in the references to the ACE element of education. Assumptions of an ecologically centered human nature relationship were rarely identified with this ACE element in the study documents.

A green-economy economic orientation aims to reduce environmental risks and resource scarcities and build a climate-resilient society through an economic approach. The assumptions of a green-economy economic orientation were found to be immersed in mentions to all forms of education across different education levels. The transition to a carbon-free society was reported as an educational objective in a few country submissions. For instance, Belgium reported introducing the concept of transition to a low carbon society by 2050 to high school students, encouraging them to explore the route towards it (Belgian NC, p. 142). The US reported that the United States Forest Service (USFS) introduced a "[green-collar] career path" to local youth between kindergarten and grade 12 as an effort to support the transition to a low carbon society (American NC, p. 248). Educational programmes related to the use of energy and sustainable mobility were also reported in the data. Several countries had university degree programmes and courses that focused on strengthening green-economy competencies, particularly in energy use. Typical examples can be found in the NCs of Denmark, Greece, and Hungary, in which university programmes with a renewable energy focus were reported in detail. Learning about energy efficiency and renewable energy was delivered through extra-curriculum educational projects in primary and secondary education. Curriculum learning was reported as the main arena for delivering the message of a green economy economic approach. Still, extra-curriculum learning complemented the goal of achieving a green economy through an alternative approach. For example, the Federal Ministry for the Environment of Germany and NGOs for Nature Conservation and Building and Nuclear Safety worked together and brought an energy conservation contest among schools in Germany (German NC, p. 240).

On the other hand, a neoliberal economic orientation prioritizes the marketization and commodification of the solutions of the climate change crisis, including the manifestation in education with a market-based competition. The neoliberal economic direction was identified in 28 references to the ACE element of education in 11 countries' NCs[20]. This was in mentions of educational programmes discussed as promoting competition among students and schools while introducing topics related to climate change. For example, Cyprus reported an annual drawing competition for children on renewable energy topics, with award ceremonies organized by the Cyprus Energy Agency (Cypriote NC, p. 205). A collegiate wind competition discussed in American NC encouraged college students to design innovative wind energy concepts in a competitive atmosphere (American NC, p. 272). The only example manifesting the neoliberal economic orientation other than promoting competition was reported in Russia's NC, which reported on an educational toolkit designed for schoolchildren with the content on climate credit, introducing the concept of marketization of a natural phenomenon (Russian NC, p. 268). Another interesting finding of the neoliberal economic orientation in the content on the ACE element of education was that the content was often associated with a green-economy economic orientation. For example, many of these programmes were promoting energy saving and renewable energy[21] in the form of competition.

Regarding the assumptions towards the ways of learning to the ACE element of education, instrumental and participatory learning were identified in a few country submissions, accounting for 47 references and 14 references, respectively. Across the study documents, programmes related to renewable energy sources (RES) were commonly reported in vocational and tertiary education. These programmes took an instrumental approach and considered technological solutions the best solution for the climate change crisis[22]. For example, Romania reported on the concept of carbon capture being prevalent in their universities and being taught through Master's programmes, providing technology-focused solutions to the climate change crisis (Romanian NC, p. 267). On the other hand, participatory learning assumed that participants could become part of the solution by taking initiatives and diving into the issues. Various extra-curriculum educational projects in primary and secondary levels of education were reported to

[20] In Belgian, American, Cypriote, German, Irish, Italian, Kazakh, Latvian, Portuguese, Russian, and Turkish NCs.
[21] For example, in American, Belgian, Cypriote, German, Irish, Kazakh, and Portuguese NCs.
[22] For example, in American, British, Cypriote, Finnish, and Greek NCs.

engage students in a participatory approach. Students were reported to take a stand and express their opinions about climate change issues (e.g., Maltese NC) or be part of the solution for environmental and climate change issues (e.g., Greek, Portuguese, and Zenalian NCs).

Regarding assumptions on the relationship between humans and nature, a resourcist human-nature relationship was often observed in the references to the ACE element of education. The expressions such as "natural resources" or "environmental management" were used to declare human ownership of nature and the natural environment in the NCs under the UNFCCC. Such examples can be found in 24 references to the ACE element of education from 15 countries. On the other hand, assumptions on an ecologically centered human-nature relationship were barely identified in the references to the ACE element of education, accounting for only three references altogether. For example, a US programme was reported to encourage participants to understand the earth as an interconnected system (American NC, p. 243), demonstrating the ecologically centered approaches.

Public awareness. In the references to the ACE element of public awareness, a green-economy economic orientation was dominant compared to other assumptions, with 374 references from 39 countries. These reported public awareness activities had a certain degree of engagement with a transition to a green economy, contributed to a sustainable and climate-resilient society, and focused on four areas: use of energy, modes of mobility, food production, and the transition to a low-carbon society.

Use of energy was the most often addressed area and was reported in 35 NCs. Various topics regarding energy use were promoted through public awareness activities, including energy-saving, energy efficiency, energy transition, and renewable energy resources. An example from Australian NC demonstrated how the topic of energy use was covered in public awareness activities: "A range of activities w[as] progressed, including: exploring community-owned energy schemes; a public art project in the central business district; a Roadmap for Energy Transition developed with unions and industry; and a series of expert speaker seminars" (Australian NC, p. 187).

Modes of mobility were another focused area and were reported by 20 countries. Topics such as choice of transport, eco-driving, vehicle choice, and infrastructure improvement for hybrid or electric vehicles served to encourage the reduction of CO_2 emissions in the mobility sector and were primarily reported in the NCs. Some international events served such a purpose

to a more considerable extent. For instance, several countries in Europe[23] reported about European Mobile Week, which was a global campaign that "promote[d] sustainable mobility on city streets and introduce[d] environmentally friendlier methods of mobility" (Estonian NC, p. 223) among European cities. Austria was particularly active in this international campaign as it was reported to have the highest participation in Europe, with more than 500 communities joining the movement (Austrian NC, p. 119).

Moreover, food production was another focused area that was identified in the reports. Some Annex I Parties reported on public awareness activities covering organic farming, smart farming, and small food mileage, promoting the reduction of GHG emissions in the agricultural sector. Sixteen countries[24] reported on the ambition of transitioning to a low-carbon society in the references to the ACE element of public awareness. The vision of a low-carbon society encompassed all three other focused areas, building a community that was featured as fossil fuel emissions-free, low-carbon living, and a green economy. While most countries reported on the path towards a low-carbon society with cautious and gradual steps, some countries reported rather aggressive moves in that direction. For example, an NGO called Coal-free Finland was reported to campaign to shut down coal plants in municipalities across Finland to make the low-carbon transition (Finnish NC, p. 284), and organizations in the Netherlands were reported on an attempt to purchase a coal-fired power plant through crowdfunding with the intention to close it down (Dutch NC, p. 218).

A neoliberal economic orientation was another widespread assumption on the content to the ACE element of public awareness in the study documents, accounting for 104 references from 29 countries' NCs[25]. The market-based competitions and the marketization of carbon and climate change crises were two primary manifestations of this type of assumption in the study documents. Most of the content related to a neoliberal economic orientation was from public awareness programmes that engaged with the public through competitions, awards, or contests. For example, the "Earth Hour City challenge" in Belgian NC, the "sustainable challenge" in

[23] For example, in Austrian, Cypriote, Estonian, Greek, Latvian, Lithuanian, Luxembourgish, Slovenian, and Spanish NCs.
[24] Belgian, British, Croatian, Danish, Finnish, Irish, Italian, Kazakh, Luxembourgish, Dutch, Polish, Portguese, Slovak, Slovenian, Spanish, and Swedish NCs.
[25] American, Australian, Austrian, Belgian, British, Croatian, Cypriote, Danish, Estonian, EU, French, Icelandic, Irish, Italian, Kazakh, Latvian, Luxembourgish, Dutch, Zenalian, Polish, Portuguese, Romanian, Russian, Slovak, Slovenian, Spanish, Swedish, Swiss, and Turkish NCs.

Croatian NC, a monthly quiz competition in Cypriote NC, and a film competition in French NC, among others, were good examples of an assumption with a market-based competition in the public awareness activities. The content related to a neoliberal economic orientation less focused on the marketization of carbon and market-oriented solutions for the climate change crisis. However, the manifestations of carbon marketization were reported in a few references to public awareness. For example, carbon trading schemes or carbon credits were reported in Australian, Italian, Slovak, Turkish, and Zenalian NCs. Carbon trading mechanisms supported carbon emissions offset in one geographic location through green actions, such as renewable energy or tree planting, in another area.

Instrumental learning and participatory learning were the following commonly identified assumptions in the content on the ACE element of public awareness. The instrumental learning assumption regarded education as an instrument to manage environmental resources and solve ecological problems. The instrumental learning assumption also regarded science and technology as the highest form of knowledge, and therefore the best solution for the climate change crisis. The instrumental learning assumption had been identified with 48 references to the ACE element of public awareness from 20 countries, with two main trends. The first trend of instrumental learning was that public awareness activities tended to guide the actions. Examples can be found in the NCs of Australia, Belgium, Canada, Cyprus, Iceland, Ireland, and New Zealand. These public awareness programmes provided instruction and intervention to secure a pre-determined behavioral outcome. For instance, Australia's "green vehicle guide" was intended to influence buyers' consumption choices towards a desired green direction (Australian NC, p. 186). In Cyprus, children were instructed to implement specific energy-saving methods at school and home (Cypriote NC, p. 205). The second trend of instrumental learning was that public awareness activities promoted technology and scientific-based solutions for environmental and climate change crises. For example, Germany launched a programme to support German companies that provided "climate-friendly energy technologies" in the global market (German NC, p. 243). In the US, a reward was set up to encourage the next generation of "best scientists and engineers to pursue breakthrough technologies" in the field of renewable energy (American NC, p. 255).

Contrary to instrumental learning, participatory learning emphasized the participatory approach and participants to be part of the solution. The primary goal of activities with

participatory learning was to get people involved, identified with 26 references to the ACE element of public awareness in 17 countries. For example, the coded content in the reports pointed to the participatory nature of such activities, such as "the aim of promoting civil society involvement in the climate change issue" (Luxembourgish NC, p. 314) and "the approach challenges and motivates students to become involved in community development" (Swedish NC, p. 133). Moreover, this way of learning motivated the participants to work on solutions collaboratively. Belgium reported on a programme that inspired participants to find out "how [they] can make [their] society evolve towards a low carbon society by 2050" (Belgian NC, p. 142). Also, in Russia's report, a competition was organized to encourage people to figure out the solutions that can reduce carbon emissions (Russian NC, p. 261).

The assumptions concerning the relationship between humans and nature in the ACE element of public awareness were rarely observed in the study documents. The assumption of a resourcist human-nature relationship was usually demonstrated with the expressions such as "natural resources" for the elements in nature, identified with only six references to the ACE element of public awareness from 5 countries. It was even rarer to link references to an ecologically centered human-nature relationship in the study documents. Perhaps the only example belonging to ecologically centered assumptions was from Italy's NC, where the climate change resilience was linked to increased biodiversity on a larger scale: "[t]he use[s] of spontaneous herbaceous vegetation to increase biodiversity in ecosystems and increase the resilience of coastal areas to climate change" (Italian NC, p. 338).

Other ACE elements. As for the ACE element of training, a green-economy economic orientation was observed in 44 references to the ACE element of training from 19 countries' NCs, focusing on energy efficiency, vehicle fuel efficiency, food production, and ultimately, transition to a low-carbon society. Overall, energy was the biggest concern in all reported training programmes across Annex I Parties. The importance of training for energy was infused in all sectors that contributed to a greener future, as described in France's report: "In order for France to have competent professionals to ensure its energy transition, several training programmes have been introduced in several key sectors for the green economy (building, energy, agriculture, land use planning)" (French NC, p. 217).

A neoliberal economic orientation was also identified in the references to the ACE element of training, accounting for 14 references from eight countries' NCs[26]. All these references involved a market-based competition in the training programmes. For example, Hungarian NC reported on a "green office" training programme to enhance office sustainability through competition between offices (Hungarian NC, p. 214). Another example can be a workforce training programme in American NC that aimed to increase the workers' skills and the global competitiveness of the country (American NC, p. 237).

The dominant assumptions embedded in the ACE element of public participation were participatory learning, which made sense given the name of this ACE element was public participation. The assumption of participatory learning was identified with 44 references to public participation from 19 countries. In the bottom-up manner of public participation, the public was described as taking the initiative to make a change. For example, the youths in Italy initiated the policy proposal for "intergenerational equity" in the time of climate change (Italian NC, p. 333). A green-economy economic assumption was also observed in a few country submissions, surrounding the ideas of energy efficiency, modes of mobility, and transition to a low-carbon society. A neoliberal economic orientation assumption was identified with a few references, referring to the competition the participants went through for the participating opportunities (Estonian NC) and the agenda for public discussion concerning carbon marketization (Canadian, Spanish, Zenalian NCs). However, other assumptions were rarely observed in the content on public participation in the study documents.

There were few references to the ACE elements of public access to information and international cooperation demonstrating coded assumptions in the study documents. A green-economy (27 references) and a neoliberal economic (10 references) orientations were identified in the references to the ACE element of public access to information. A green-economy economic orientation was associated with the themes of energy, mobility, food production, transition to a low-carbon society, and a neoliberal economic orientation manifested in the information that the public has access to. For instance, Belarus, Spanish, Turkish, Zenalian NCs all reported that their public had access to information associated with the idea of carbon marketization. Moreover, instrumental learning (10 references) and participatory learning (3 references) were identified in the references to the ACE element of public access to information.

[26] In American, Canadian, Hungarian, Kazakh, Polish, Portuguese, Slovenian, and Swiss NCs.

In contrast, no references were identified with either an ecologically centered or a resourcist human-nature relationship in the ACE element of public access to information. As for the ACE element of international cooperation, all six assumptions were identified with the references coded to this ACE element but only a few references[27].

[27] 19 references identified with a green-economy economic orientation, 8 with a neoliberal economic orientation, 7 with instrumental learning, 1 with participatory learning, 1 with an ecologically centered human nature relationship, and 4 with a resourcist human nature relationship.

Chapter 5: Implications and Significance of the Thesis

Since the formation of the UNFCCC in 1992, the Action for Climate Empowerment (ACE) elements of education, training, public awareness, public access to information, public participation, and international cooperation have been supposedly introduced into all Parties' practices and policies. The actualization of all the ACE elements holds great importance in informing and preparing global society for the climate change crisis. So far, some studies have investigated CCE/ACE-related practices and policies in formal education settings (e.g., Blum et al., 2013; Henderson et al., 2017; Lovett et al., 2018; Monroe et al., 2019), but very few studies have focused on CCE/ACE engagement in non-formal education settings (e.g., Wibeck, 2014). Thus, we have limited knowledge of CCE/ACE-related practices and policies in the public sphere. Social science researchers, especially education policy researchers, need to contribute more knowledge and understanding about where and how intergovernmental conventions and national governments lead us and future generations.

As an effort to fill these gaps in the academic community, this thesis builds on the work of previous SEPN and UNESCO's CCE monitoring studies (UNESCO, 2019; McKenzie, 2021) and attempts to gain an in-depth understanding of how Annex I Parties' engagement with ACE activities looks like, as reported in their NCs under the UNFCCC. The research question is explored through three sub-questions: (i) How are Annex I Parties engaged with the six ACE elements, as reported in the NCs? (ii) How are Annex I Parties engaged with the policies in relation to ACE, as reported in the NCs? (iii) What are the prevalent assumptions underlying the reported practices and policies in relation to ACE?

Through exploring these questions, the thesis findings contribute to the CCE/ACE practice and policy literature, fill the gaps in the CCE/ACE policy research, and make recommendations for future research, intergovernmental organization, and policymakers. In what follows, I will describe the significance and implication of this thesis study.

Implications and Recommendations for Practices and Policy

Incorporating CCE/ACE into policy. Previous research showed that although the need for CCE/ACE policy was emerged out of the necessity to combat the growing global climate change challenges (UNESCO, 2010), there were numerous barriers to incorporating CCE/ACE into policy for formal education. One of the barriers identified in the earlier literature was that EE/ESD, including CCE/ACE, was not yet a subject-specific curriculum in educational policies.

Instead, it was carried out through an interdisciplinary approach and mainly aligned with science education (Aikens et al., 2016). This thesis study further confirmed the challenges of mainstreaming CCE/ACE in the education curriculum, particularly in primary and secondary education, as reported in Annex I Parties' NCs. Curriculum integration was a focus of the content to the ACE element of education. However, ACE was reported as multi-curricular or cross-curricular content in both primary and secondary education and was often integrated into existing subjects, namely science, geography, biology, physics, chemistry, and social science. A few NCs reported on the inclusion of ACE content in their national curriculum for various subjects mentioned above, including British, Estonian, Slovenian, and Swiss NCs. It was evident that the ACE content has not gained an independent position in formal education yet.

The previous literature argued that the interdisciplinary approach could further marginalize climate change-related education in many ways. For example, CCE/ACE could be neglected as an add-on knowledge in an already overcrowded curriculum (Jucker, 2011) or compete with other educational priorities (Aikens et al., 2016). On the contrary to previous research findings, this thesis study found the ACE activities were widely accepted as an extra-curricular study in the Annex I Parties as reported in their NCs. The NCs commonly reported extra-curricular ACE activities as a supplementary approach to curriculum learning. These ACE activities did not belong to any particular subject curriculum, but they offered meaningful ACE learning experiences in various educational projects. For example, "Bike2school challenge" in Belgian NC, "Energy clubs" in Turkish NC, "energy-saving competition" in Cypriote NC, "national energy awareness week" in Finnish NC, and "Slovenia is reducing CO2: good practices 2015" in Slovenian NC, among others. These programmes were an essential educational component in the ACE element of education, as reported in the NCs.

The previous literature concluded that another barrier to mainstreaming CCE/ACE in the educational policies was the insufficient support for teachers due to lack of a national mandate for ACE activities (Aikens et al., 2016; Kennelly et al., 2008; Læssøe et al., 2009). In this thesis study, the support for teachers seemed to be improved, and teacher training has been a primary focus in the reported ACE activities in the ACE element of education, especially at the secondary level of education. Many Annex I Parties reported that they offered training opportunities to teachers to equip them with the knowledge and tools needed to incorporate climate change into pedagogy. Resources, such as training courses and teaching instructions, provided teaching tools

and strengthened teachers' competencies. Several countries also reported that supplementary educational materials for teachers and schools were widely available online, supporting school education and making self-learning accessible. The American NC reported that teacher training opportunities not only benefited teachers but also spread the impact of ACE to the broader student community through the process of teaching and learning, stating that "more than 100,000 teachers have received training and instructional resources, which have benefited millions of students" (American NC, p. 243).

Moreover, this thesis also identified national legislation and laws, national strategic plans, and guidelines and action plans in the NCs related to the ACE element of education. Similarly, as CCE/ACE's incorporation into the curriculum, these policies were rarely education-specific; ACE content was more likely to be included in policies with a broader focus. For example, in French NC, "the Energy Transition for Green Growth Act" placed ACE activities in the center to realize energy transition and combat climate change.

There were limited studies on CCE/ACE policy for non-formal and informal education. The thesis findings also showed that fewer policies in relation to ACE were reported for non-formal education. Those were mainly national laws and Acts for the ACE element of public access to information, legitimizing the public's rights to access environmental information, including climate change information.

Overall, the barriers identified in the prior studies to incorporate CCE/ACE into formal education curriculum still existed across Annex I Parties, but some of these challenges started to be addressed as reported in the NCs. Further research is recommended to understand better how these changes happened and what they meant to CCE/ACE policy research. Future research can also investigate policies related to ACE activities in non-formal education.

Government and other actors' roles in CCE/ACE engagement. Several existing studies in the literature suggested that governance styles determined which level of government played an active role in relation to CCE (Feinstein, Jacobi, & Lotz-Sisitka, 2013; Læssøe & Mochizuki, 2015; Lovett et al., 2018). Lovett et al. (2018) found that countries with centralized national educational governance had more nationwide power over policymaking and implementation, while countries with decentralized or federated education governance afforded more flexibility to provincial or state level governments to employ the most suitable approach. Although the findings from this thesis did not directly support this conclusion, I observed that

some countries characterized as federal states or other similar decentralized political systems were more likely to include subnational activities related to the ACE elements in their NCs. Taking Belgium as an example, Lovett et al. (2018) stated that Belgium's decentralized system enabled different non-state actors to provide teaching and learning tools for CCE, while this thesis study observed that Belgian NC focused on reporting ACE activities at the regional/subnational level and as carried out by various non-state actors.

Previous research also suggested that the cooperation between governments and other key actors, such as civil society, played an essential role in CCE/ACE engagement, regardless of geographic level. Feinstein, Jacobi et al. (2013) observed various types of intertwining relationships between governments and non-state actors in a few countries with similar decentralized political systems, indicating the complexity of the cooperation. In this thesis, the content on the ACE elements also suggested that the governments took the leading roles in implementing ACE elements across Annex I Parties, whether that was national, subnational or regional, and local level government. Other prominent actors reported were educational institutions and NGOs for the ACE element of education, NGOs for the ACE element of public awareness, and think tanks for the ACE element of public access to information. The collaboration within government agencies and between government bodies and other organizations was prevalent across the study documents. Such joint efforts were commonly undertaken to promote the ACE elements in the reporting countries, indicating that promoting the ACE elements in Annex I Parties required input from various actors in the society. However, the research findings suggested that the Annex I Parties' NCs did not place equal focus on reporting the contributions of multiple actors, with more emphasis on government-led activities. The imbalanced reporting focus on governments may be due to various factors. These included governments having access to resources that other actors may not have to conduct ACE activities, or the governments were less aware of other activities, or the contributions from different actors were not reported enough in the NCs, or finally, that there were relatively few non-government led ACE activities in countries. Further research is recommended to investigate what the non-government actors' roles are in implementing ACE elements and how various actors can support ACE implements in Annex I Parties.

In addition to the influence of government and other actors on CCE/ACE inclusion in policy, Blum et al. (2013) and Lovett et al. (2015) also observed that external pressures, such as

international events, can create opportunities to advance CCE/ACE policy at the national level. Through this thesis, I observed that international drivers were reported in the references to the ACE element of public awareness, including international conferences and international initiatives. The UN climate change conference, such as COP 21, was particularly noticeable in the reported ACE activities, as several NCs reported on public awareness activities organized before, during, or immediately after this conference. The findings of this thesis study further confirmed the observation of the previous research. However, COP 21 was repeatedly reported in the NCs as an external influence for national CCE/ACE policy. It requires further research to identify to what extent the international conferences influence ACE-related policies at the national level.

Assumption analyses in CCE/ACE practices and policies. Prior studies acknowledged the importance of analyzing assumptions underlying education and education policy. For example, neoliberalism was an economic paradigm that influenced all social domains, including the manifestation in education and education policy as market-based competition and commodification (McKenzie et al., 2015). Sauvé et al. (2007) observed the resulting emphasis on education's instrumental role, particularly in many intergovernmental organizations, that positioned learning as an instrument and prioritized scientific and technological knowledge. In addressing the human-nature relationship, Bowers (2007) advocated an ecologically centered ideology that emphasized interconnectedness among humans, cultural patterns, and the natural environment, while Sauvé et al. (2007) found that the focus on education's instrumental role also accentuated a resourcist view that treated the environment as resources to serve human needs. The literature that examined the ideologies and assumptions underlying education and education policy was scarce and even more rarely focused on a global scale. This thesis investigated the assumptions indicated in the content related to ACE across 44 nations, providing a unique opportunity to address this gap in education policy research.

The thesis findings suggested connecting ACE with economic solutions across Annex I Parties' NCs under the UNFCCC. Remarkably, the manifestation of a green economy associated with low GHG emissions was significant across Annex I Parties' NCs, indicating an assumption that human society operating on a green economy will automatically reduce climate impact and eventually solve the climate change crisis. A neoliberal economic orientation associated with a market-based competition and marketization of carbon was prevalent in the content on the ACE

elements, suggesting a different financial solution for the climate change crises in the educational approach. In some cases, both the green economy and the neoliberal economic orientations can be identified in the same references to the ACE elements. This intersection of both economic orientations was evident particularly in the ACE element of education, where the programmes can promote a green-economy-focused activity while employing a market-based competition as a method.

As Læssøe et al. (2013) pointed out, identifying, analyzing, and understanding the ideologies and assumptions in education policy was important, as it could reveal the intentions and consequences of particular policy regimes. In this thesis study, Annex I Parties overwhelmingly focused on the green economy and neoliberal economic orientations in their NCs. They reported very little on the ecologically centered human-nature relationship in ACE, indicating that Annex I Parties favored reporting a tangible, fast, and measurable educational approach over a holistic, long-term, yet unmeasurable approach to ACE. It would be interesting to conduct further research on assumptions in ACE-related practices and policies in Annex I Parties. For example, what do these preferable economic orientations in ACE mean to the ACE engagement in practices and policies across Annex I Parties?

Inclusion of Indigenous knowledge in CCE/ACE policy. In an ESE research conducted in a federated country, Canada, Aikens and McKenzie (2021) found a localized, relevant, and Indigenous-focused ESE approach was employed in a territory with rich Indigenous culture and heritage. This thesis also found that Indigenous-related content was rarely reported in relation to ACE in Annex I Parties' NCs under the UNFCCC. There were only two Annex I Parties' NCs (American and Zelanian NCs) that included references to Indigenous peoples in relation to the ACE content. For example, in the references to the ACE element of training, the American NC reported on its training courses targeting Indigenous groups domestically and Indigenous leaders in tropical regions overseas. At the same time, Zelanian NC reported on the involvement of Indigenous peoples in its public consultation process in the references to the ACE element of public participation.

Indigenous knowledge focus was rare in the CCE/ACE-related policy research. In contrast, they represent a holistic view and provide an alternative solution to the current climate change crisis. The lack of inclusion of Indigenous peoples and their perspectives in the NC sections on ACE was evident. Future research can offer more insights into the Indigenous

knowledge in the practices and policies related to ACE and help understand how this unique way of learning and doing helps us combat the climate change crisis.

Recommendations for the UNFCCC Secretariat. In the NCs, the engagement with the ACE elements of education, public awareness, training, public access to information, and public participation focused on the national level, while the ACE element of international cooperation focused on the international level. However, countries characterized as federal states or similar decentralized political systems were more likely to include regional activities related to ACE in their NCs. The current "guidelines for the preparation of national communications by Parties included in Annex I to the Convention" for education chapters did not specify the geographic areas where the ACE activities should be reported (UNFCCC, 2000b, p. 98). The geographic trends indicated that the NCs were subject to countries' interpretation of the UNFCCC guidelines for Annex I Parties NCs. Therefore, it was the Annex I Parties' choice to incorporate regional ACE activities into their NCs. For example, some federal states reported on limited or no regional activities (e.g., American and Canadian NCs), while other countries with decentralized political systems emphasized regional activities in their NCs (e.g., Belgian, Italian, Spanish NCs).

Therefore, a national-focused reporting structure may not suit all Annex I Parties as some of their governance styles were decentralized. The lack of a reporting mechanism that specifies reporting regional activities in the NCs may result in an inaccurate picture of the engagement with ACE in the countries with decentralized political systems. Therefore, this thesis study suggested that the UNFCCC Secretariat encourage the Annex I Parties reporting at the geographic levels that suit the country context.

Implications and Recommendations for Research

Research on CCE/ACE engagement in formal and non-formal education. There was a relative absence of research on CCE practices in formal and non-formal education settings (Blum et al., 2013; Læssøe & Mochizuki, 2015; Monroe et al., 2019; Wibeck, 2014). Blum et al. (2013) noted a lack of studies on ESD and CCE practices in formal education despite the rich conceptualization of these two terms and supportive policies enacted at various jurisdictional levels. How CCE/ACE was engaged within the public sphere through non-formal and informal education largely remained unexplored (Monroe et al., 2019). This thesis work partially addressed this gap in the CCE/ACE research field.

In this thesis, the target audiences of the ACE activities defined whether they were formal or non-formal education. The research findings suggested that all Annex I Parties have engaged with ACE-related activities in formal and non-formal education settings in their NCs. The reported activities to the ACE elements of education, training, and international cooperation mainly targeted formal education, from primary through tertiary education, including vocational education. In contrast, the content to the ACE elements of public awareness, public access to information, and public participation was considered non-formal education, as these activities targeted the general public. It was worth noting that some content in relation to the ACE elements of training and international cooperation were considered non-formal and informal education as their target audience was the general public.

In formal education, ACE-related content was reported to be integrated into degree programmes or courses in tertiary education, training programmes in vocational education, curriculum, and extra-curricular study in secondary and primary education, as reported in the NCs. Thirty-three Annex I Parties reported on including climate change content in their tertiary education, indicating that most Annex I Parties identified the need to prepare future professionals with climate change knowledge and actively invested in it. In contrast, 28 and 28 Annex I Parties reported on ACE activities in secondary and primary education. These countries reported on the involvement of ACE content in curriculum and extra-curriculum study. Noticeably, they placed almost equal emphasis on curriculum and extra-curriculum study in their NCs. Extra-curricular afforded more flexibility when introducing ACE in secondary and primary education, especially when the barriers to incorporating ACE into the curriculum were too significant. However, more research is needed to examine how best to introduce ACE in formal education through extra-curriculum learning.

In the non-formal education approach to CCE/ACE, Wibeck (2014) concluded that communication with positive, visualized, personally relevant, and audience-specific content can further boost public engagement in CCE. This thesis found that audience segmentation was often used as a public communication strategy on ACE-related activities as reported in the NCs. The American NC further identified it as an effective communication strategy and used this approach in various public communication portals; their NC stated that “different audiences have different information gaps and misconceptions and want to know different things” (American NC, p. 234). In other countries’ NCs, although it was not specifically reported as an ACE communication

strategy, the audience segmentation approach was commonly reported in their NCs. For example, research projects (Danish NC) and journal articles (Russian and Slovak NCs) were reported as approaches to engaging with scientific communities, differentiated from other target audiences. However, non-formal and informal education required more attention in CCE/ACE practices research, and further research can help address this gap. For example, it was interesting to explore the extent to which the ACE activities were delivered in the public sphere, what approaches were employed by Annex I Parties, and how to effectively communicate ACE to the public.

Wibeck (2014) also identified an ongoing transition in the public ACE communication, shifting from enhancing the public's scientific knowledge on climate change to engaging more participation. However, this transitioning was not evident in this thesis; more research is needed to verify it. In this thesis study, three learning dimensions (cognitive, behavioral, and socio-emotional) were identified in the content to the ACE elements. The findings suggested that the ACE elements of education, public awareness, training, and public access to information focused on promoting the cognitive learning dimension, such as the concept knowledge to understand climate change. The behavioral learning dimension can be identified in the content related to the ACE elements of education and public awareness but rarely discovered in the content on other ACE elements. The socio-emotional learning dimension was the most under-addressed learning dimension. The emphasis on cognitive learning indicated that the reported activities focused more on improving participants' cognitive knowledge than action competencies or attitude changes concerning climate change. Therefore, the transition that previous studies observed might still be happening but slower; further research is needed.

Research methods. Document content analysis was commonly employed in the CCE/ACE policy research, with documents as the only sources of data (e.g., Bieler et al., 2017; Henderson et al., 2017; Pizmony-Levy et al., 2021; Zacharious & Korfiatis, 2021). This thesis followed the research methods previously employed by SEPN's CCE/ACE policy research and included a dataset of 44 education chapters of Annex I Parties' NCs. However, the inherent disadvantage and limitations of document type of data, such as insufficient detail, low retrievability, and biased selectivity (Bowen, 2009; Merriam & Tisdell, 2015), were evident in the data analysis for this thesis. The education chapters of Annex I Parties' NCs were produced to report on the ACE progress under the UNFCCC; they were not specified for the research

purposes. The NCs may not provide a complete picture of what has happened in these countries. In other words, the analyses of this thesis study may have missed out on some important aspects of Annex I Parties' actual engagement with CCE/ACE.

Moreover, the analyses on the policies in relation to ACE were done through the content to the ACE elements in the NCs, which were self-reported documents based on what the authors were aware of. Therefore, the findings on the Annex I Parties' engagement with ACE-related policies as reported in NCs were not comprehensive to understand the actual engagement in these countries. Further research on CCE/ACE policies in Annex I Parties can include more data collection methods and employ data triangulation to increase data credibility, as Bowen suggested (2009).

Furthermore, as suggested in the literature review, international comparative CCE/ACE policy analysis has rarely been done on a broad scale globally. Partially to address this gap in the literature, this thesis carried out an international comparative analysis on practices and policies concerning ACE across 44 countries, providing insight into the countries' engagement with practices and policies related to ACE across Annex I Parties.

Conclusion

The literature review conducted for this thesis showed a shortage of CCE/ACE policy research in general, particularly in non-formal and informal education settings. Non-formal and informal education played an essential role in mobilizing society and requires more attention in education policy research. Furthermore, various ideologies and assumptions underlying educational policies have rarely been examined on a broad scale globally.

This thesis addressed these research gaps through document content analysis on Annex I Parties' engagement with ACE-related practices and policies as reported in their NCs under the UNFCCC. The thesis examined CCE/ACE engagement in formal education and provided more evidence that although CCE/ACE was not yet mainstreamed in the curriculum study, extra-curricular learning was welcomed in formal education to promote ACE activities. The ACE element of public awareness was the most reported ACE element in the NCs, together with the content to the ACE elements of public access to information and public participation; the findings in relation to these ACE elements suggested non-formal education was an essential part of CCE/ACE activities. Further research is recommended regarding CCE/ACE practices and policy research in formal and non-formal education.

The thesis also analyzed the assumptions in content to the ACE elements and identified that green-economy and neoliberal economic orientations were the most prevalent assumptions in the reported ACE activities. These findings confirmed the observation from previous literature and provided new evidence on the connection between economic solutions for the climate change crisis and educational approaches. Further research is recommended to investigate the influence of these assumptions on the ACE engagement in practices and policies across Annex I Parties.

Moreover, the thesis also contributed to the literature on CCE/ACE-related practice and policy research. More findings on incorporating CCE/ACE into policy and government and other actors' roles in CCE/ACE engagement were added in the existing literature, providing more knowledge to the research community. However, more research gaps were identified through this thesis work. For example, the inclusion of Indigenous peoples and their traditional knowledge was limited in the reported ACE activities; the countries with the decentralized political system may or may not include subnational or regional ACE activities in their NCs due to the unclear instructions in the UNFCCC NC guidelines. Recommendations were made for addressing these gaps.

Nevertheless, this thesis research had many limitations. Some of those inherent limitations for using documents as the only data sources, such as build-in biases and insufficient detail, were especially evident in the data analysis. The large scope of the dataset also posed a challenge to get an in-depth understanding of the research questions. Some of those were due to the researcher's limitation in research capacity and academic writing skills. For future research on ACE-related practices and policy engagement, researchers and the research community can benefit more by considering the following: narrowing down the scale of the study countries to gain an in-depth analysis, triangulating the data by including more sources of data, among including more research methods.

I look forward to seeing more interest and resources are navigated and contributed to CCE/ACE policy research in the future. Moreover, in facing escalated climate change crises, the whole society needs to be mobilized to lower the current projected rate of global warming. CCE/ACE is in the frontline of these battles as one of the most powerful tools to help the public make informed and correct decisions. The observed relatively low engagement with policies in relation to ACE across Annex I Parties is worrisome. Remarkably, the policies to address ACE

activities in the non-formal education settings, or the public sphere, were rarely reported in the Annex I Parties' NCs. It is alerting that the ACE activities towards the public may fall through or sideways due to the lack of legal grounds from policies. I strongly urge the policymakers and authorities in Annex I Parties to promptly address ACE activities from the policy level. Whether we can secure the future of humanity relies on what we do in the next decade or so; strong policy support for ACE activities is urgent!

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Appendix A: List of Annex I Parties in the Thesis Research.

Regions	Countries
America	Canada, the US
Asia	Japan, Kazakhstan
Europe	Austria, Belarus, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, EU, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Monaco, Netherland, Norway, Poland, Portugal, Romania, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom of Great Britain and Northern Ireland, Ukraine
Oceania	Australia, New Zealand

Category	Code	Definition
Geographic Level	International	Indications that the ACE programme or activity is occurring at the international level.
	National	Indications that the ACE programme or activity is occurring at the national or federal level.
	Regional	Indications that the ACE programme or activity is occurring at the state, provincial, territorial, or school division level. May require additional analysis to separate out state, provincial, and territorial references from school division references.
	Local	Indications that the ACE programme or activity is occurring at the municipal or local level.
Elements & Strategies of Climate Change Education/ACE (ACE elements)	Education (Formal)	Formalized programmes or activities that seek to achieve profound, long-term changes in understanding of climate change, particularly among young people, resulting in greater national action and commitment. Delivered via educational curricula, training of trainers and teachers, and adequate pedagogies.
	Training	Programmes or activities designed to teach specific practical skills to individuals, communities, and organizations that have an immediate practical application.
	Public Awareness	Outreach programmes or activities that use targeted, systematic communications to inform the public. Offered by governments, non-governmental organizations, Intergovernmental organizations, UN agencies.
	Public Access to Information	Programmes or activities that ensure climate information, data, and statistics is freely available to all citizens via technology such as databases and the Internet, and including accessibility in multiple languages, to support development of effective policies and citizen engagement in enacting policies.
	Public Participation	Programmes or activities that ensure citizens are able to participate in climate change policy decision-making to implement climate mitigation and adaptation activities.
	International Cooperation	Programmes or activities for sharing success stories, exchanging personnel, and strengthening institutional capacity amongst governments and relevant stakeholders to enhance capacity for climate-change related expertise as well as financial and technical resources.
	National ACE Strategy	A long-term, strategic set of activities comprising a national strategy for achieving action for climate empowerment (ACE).
SDG13.3.1 Indicator Components	Mitigation	Primary to tertiary education designed to reduce climate change.
	Adaptation	Primary to tertiary education designed to develop the skills, capacities and attitudes for adaptation in the face of already evident and looming climate impacts.
	Impact Reduction	Primary to tertiary education designed to reduce the impacts of climate change related to natural disasters.
	Early Warning	Primary to tertiary education designed to encourage the development of early warning systems for severe and/or abrupt climate change (e.g., flash floods, heat waves, severe storms).

SDG 4.7.1 and 12.8.1 Indicator Components	National Education Policies	ESD (including climate change education) in national education laws, national strategic plans, and/or national curriculum frameworks.
	Curriculum	ESD (including climate change education) in curriculum – i.g. included in the design, planning and sequencing of teaching and learning process. May include subject-specific curricula; excludes national curriculum frameworks.
	Teacher Education	ESD (including climate change education) in formal teacher training (pre-service or in-service), for example, equipping teachers with the knowledge, attitude, behaviour and skills required for teaching climate
	Student Assessment	Evaluation of individuals' achievement of ESD (including climate change education) learning objectives (e.g. written, oral and practical tests/examinations, projects and portfolios).
Learning Dimensions for Indicator Components	Cognitive	Aimed at developing knowledge and thinking skills necessary to better understand.
	Social and Emotional	Aimed at developing social skills that enable learners to collaborate, negotiate and communicate as well as self-reflection skills, values, attitudes and motivations that enable learners to develop themselves.
	Behavioral	Aimed at developing action competencies.
Target Audience	Primary Education	The customary or legal age of entry is usually not below 5 years old nor above 7 years old. This level typically lasts six years, although its duration can range between four and seven years. Primary education typically lasts until age 10 to 12 (often Grades 1-6).
	Secondary Education	Secondary education is typically attended by youth aged 12/13 through to age 17/18 (often Grades 7-12).
	Tertiary Education	Tertiary education builds on secondary education, providing learning activities in specialized fields of education. Students are typically aged 18 or older. Also known as higher or post-secondary education.
	General Formal Education	References to formal education or schooling not including references to primary, secondary, or tertiary education; can be holistic references to the overall formal education system within a country, or references to a formal education programme without specifying level.
	Industry	Programmes or activities designed to develop responses to climate change in sectors that process raw materials and manufacture goods (e.g. resource extraction, energy, construction, transportation, technical).
	Government	Programmes or activities targeted to share information on climate change with policy decision-makers including government staff, ministries, departments, and politicians at municipal, regional (e.g. state, provincial, territorial), and federal levels.
	Non-Governmental Organization	Programmes or activities designed to provide non-governmental organizations (also known as non-profit organizations, civil society organizations) with information to develop their own climate change education and/or communication programs.
	Scientific Community	Programmes or activities designed to increase climate change research by targeting scientists, researchers, thought leaders, think tanks, and innovators.
	Others	Other audiences targeted by a climate change education programme (e.g. lobbyists, banking sector).

Appendix C: Additional Coding Scheme.

Code	Sub-code	Definition
CCE-Related Policies		Climate change in education laws, strategic plans, and/or curriculum frameworks at national, regional, and local level.
Actors	Government	CCE programmes or policies are developed, financed, and/or implemented by policy decision-makers including government agencies, ministries, departments, and politicians at local, regional (e.g., state, provincial, territorial), and federal levels.
	Non-government/Civil Society Organization	CCE programmes or policies are developed, financed, and/or implemented by non-governmental organizations (also known as non-profit organizations, civil society organizations).
	Education Institution	CCE programmes or policies are developed, financed, and/or implemented by educational institutions, including primary, secondary, and tertiary education.
	Industry	CCE programmes or policies are developed, financed, and/or implemented by sectors that process raw materials and manufacturing (e.g., resource extraction, energy, construction, transportation, technical).
	Think Tanks	CCE programmes or policies are developed, financed, and/or implemented by a research institute that performs research and advocacy concerning topics such as social policy, political strategy, economics, military, technology, and culture. Most think tanks are non-governmental organizations, but some are semi-autonomous agencies within government or are associated with particular political parties or businesses. (wikipedia)
Assumptions	Resourcist Human Nature Relationship	CCE programmes or policies that view the environment as a pool of resources, on which human's economic and social development rely.

	Ecologically -centered Human Nature Relationship	CCE programmes or policies that recognize the connection between humans and natural systems, value the traditional knowledge, and contribute to a long-term sustainable relationship between humans and nature.
	Instrumental Learning	CCE programmes or policies that indicate education is an instrument to manage environmental resources and to solve environmental problems. This also views scientific and technologically based knowledge as the highest form of knowledge, therefore the best solution to tackle climate change crisis. In this approach, a pre-determined behavioral outcome of an educational activity is known and can be achieved through carefully designed intervention.
	Participatory Learning	CCE programmes or policies that establish common objectives through interactions and invite participants to be part of the solutions for climate change issues. In this approach, a pre-determined behavioral outcome does not exist, rather, participants are actively involved and self-determine the solutions.
	Neoliberal Economic Orientation	CCE programmes or policies that prioritize marketization and commodification of the solution of climate change crisis, including the process of education (whose manifestation includes the commodification of learning, teaching, research, and school administration, amplification of market-based competition, the privatization of education, etc.)
	Green-economy Economic Orientation	Policy and practice that aim at reducing environmental risks and resource scarcities, and aim for a sustainable and climate-resilient society. It focuses on the area of use of energy, modes of mobility, and food production.

Appendix D: Matrix Coding Query Results.

1. Matrix coding query result for ACE elements by geographic level:

	Internationall	Local	National	Regional
Education	24	30	154	32
Training	22	12	93	14
Public Awareness	74	114	371	121
Public Access to Information	16	10	147	21
Public Participation	11	7	60	8
International Cooperation	138	7	28	3

2. Matrix coding query result for ACE elements by target audience:

	Government	Industry	NGO	Scientific Community	General Formal Education	Primary Education	Secondary Education	Tertiary Education	Others
Education	7	3	1	3	101	99	140	200	17
Training	26	36	4	1	12	6	8	7	56
Public Awareness	82	34	23	21	54	50	58	27	190
Public Access to Information	14	14	2	7	8	1	2	2	58
Public Participation	4	2	9	2	2	0	0	0	22
International Cooperation	18	6	8	7	5	2	5	21	11

3. Matrix coding query result for ACE elements by actors:

	Education Institution	Government	Industry	NGO	Think TTanks
Education	85	124	4	37	8
Training	12	80	8	17	8

Public Awareness	31	468	21	135	42
Public Access to Information	13	176	5	12	29
Public Participation	0	45	1	13	2
International Cooperation	25	93	2	14	16

4. Matrix coding query result for ACE elements by learning dimensions:

	Cognitive	Behavioral	Socio-emotional
Education	109	51	21
Training	17	16	2
Public Awareness	401	150	52
Public Access to Information	72	11	4
Public Participation	2	8	2
International Cooperation	5	2	7

5. Matrix coding query result for ACE elements by policies:

	Policies
Education	14
Training	1
Public Awareness	2
Public Access to Information	10
Public Participation	1
International Cooperation	0

6. Matrix coding query result for ACE elements by Policies by geographic level:

	Internationall	Local	National	Regional
CCE-related policies	0	1	34	4

National ACE Strategy	1	1	53	1

7. Matrix coding query result for ACE elements by Policies by target audience:

	Government	Industry	NGO	Scientific Community	General Formal Education	Primary Education	Secondary Education	Tertiary Education	Others
CCE-related policies	1	0	0	0	6	9	10	1	2
National ACE Strategy	3	1	1	0	3	3	3	1	1

8. Matrix coding query result for ACE elements by Policies by actors:

	Education Institution	Government	Industry	NGO	Think TTanks
CCE-related policies	0	19	0	0	0
National ACE Strategy	0	39	0	3	0

9. Matrix coding query result for policies ACE elements by Policies by learning dimensions:

	Cognitive	Behavioral	Socio-emotional
CCE-related policies	2	1	1
National ACE Strategy	2	1	2

10. Matrix coding query result for ACE elements by Policies by assumptions:

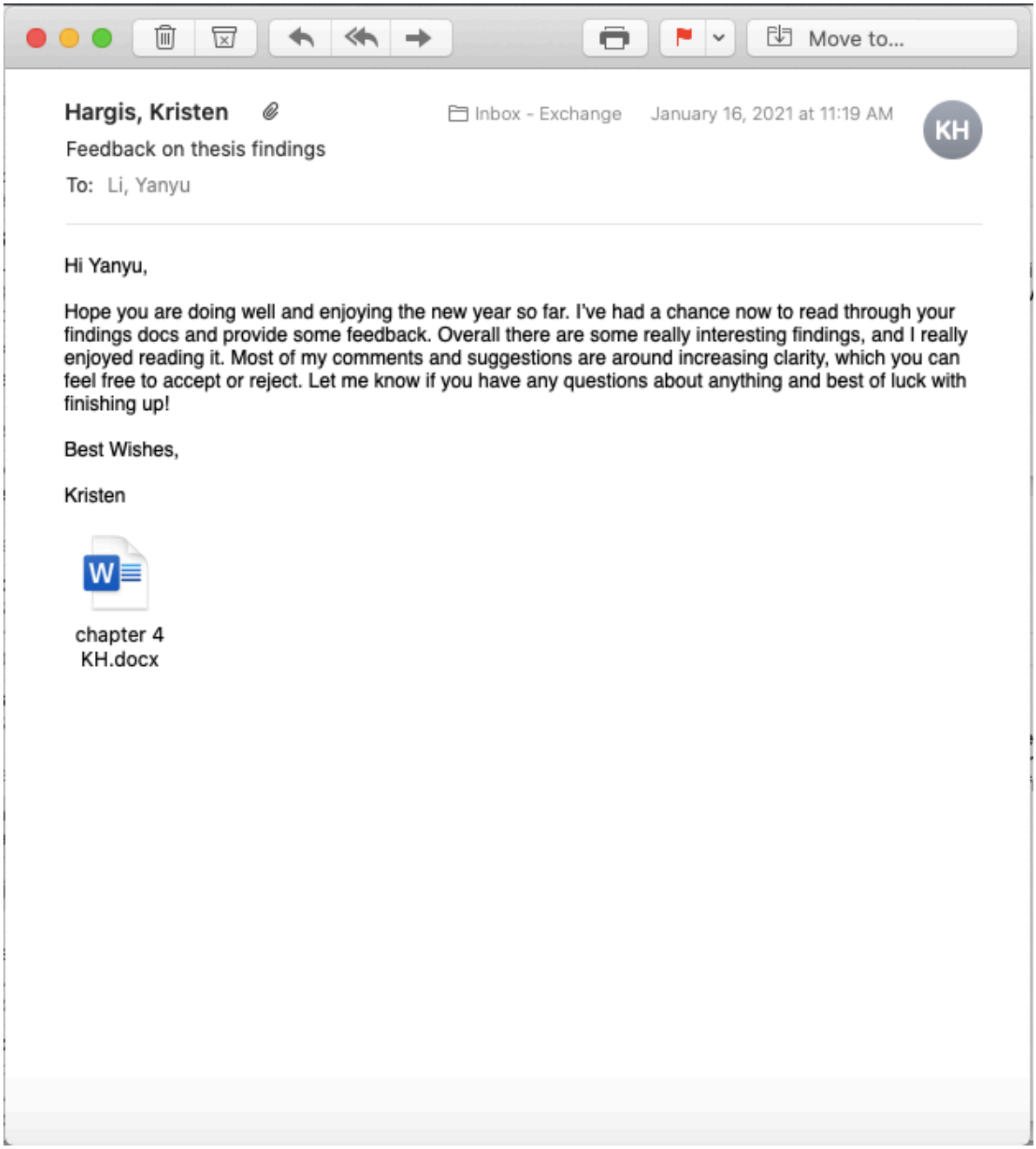
	Ecologically-centered Human Nature Relationship	Resourcist Human Nature Relationship	Participatory Learning	Instrumental learning	Green-economy Economic Orientation	Neoliberal Economic Orientation
CCE-related policies	0	0	1	0	0	3

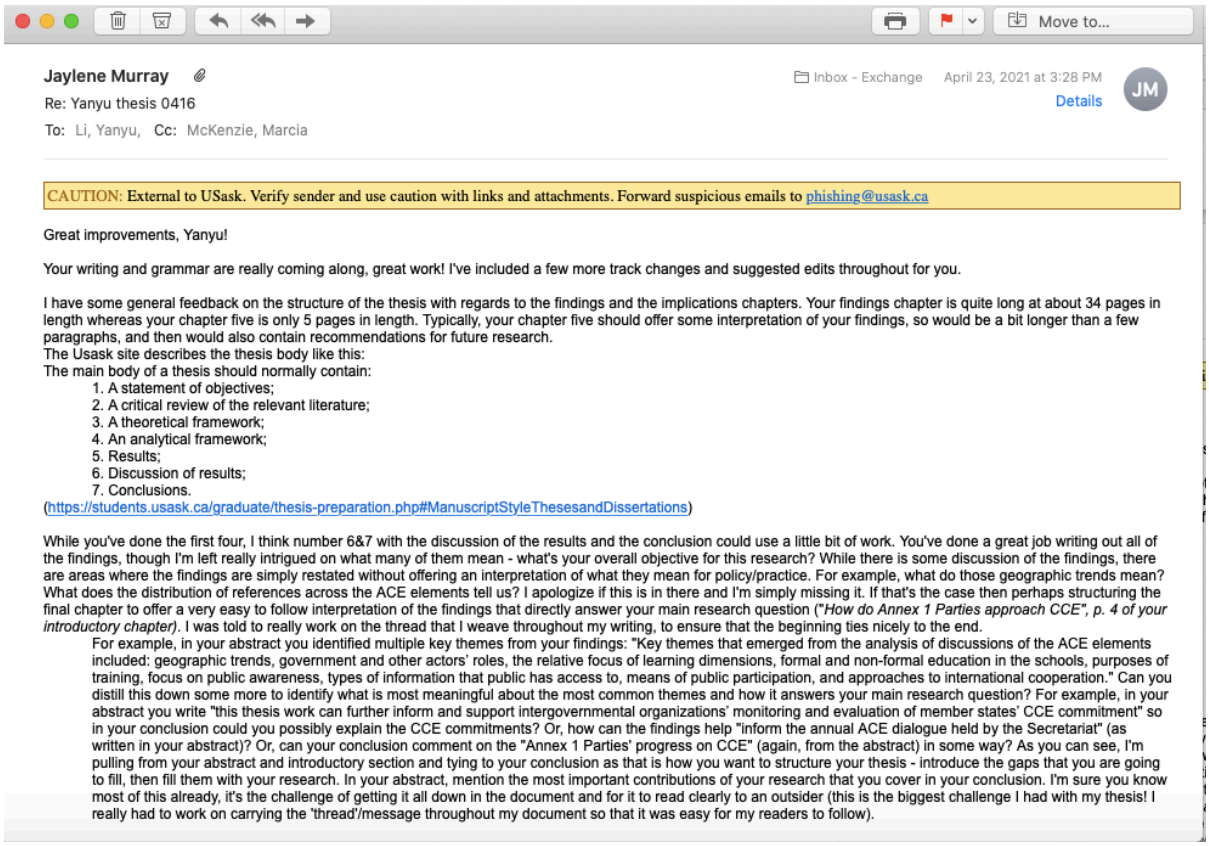
National ACE Strategy	0	0	5	1	2	0

11. Matrix coding query result for ACE elements by assumptions:

	Ecologically-centered Human Nature Relationship	Resourcist Human Nature Relationship	Participatory Learning	Instrumental Learning	Green-economy Economic Orientation	Neoliberal Economic Orientation
Education	3	24	14	47	101	28
Training	0	5	1	6	44	14
Public Awareness	2	6	26	48	373	86
Public Access to Information	0	0	3	10	27	10
Public Participation	0	1	44	1	10	5
International Cooperation	1	4	1	7	19	8

Appendix E: Validate Research Findings Through Peer Review.





Move to...

Jaylene Murray

Re: Yanyu thesis 0416

To: Li, Yanyu, Cc: McKenzie, Marcia

Inbox - Exchange April 23, 2021 at 3:28 PM

Details

JM

CAUTION: External to USask. Verify sender and use caution with links and attachments. Forward suspicious emails to phishing@usask.ca

Great improvements, Yanyu!

Your writing and grammar are really coming along, great work! I've included a few more track changes and suggested edits throughout for you.

I have some general feedback on the structure of the thesis with regards to the findings and the implications chapters. Your findings chapter is quite long at about 34 pages in length whereas your chapter five is only 5 pages in length. Typically, your chapter five should offer some interpretation of your findings, so would be a bit longer than a few paragraphs, and then would also contain recommendations for future research.
The Usask site describes the thesis body like this:
The main body of a thesis should normally contain:

1. A statement of objectives;
2. A critical review of the relevant literature;
3. A theoretical framework;
4. An analytical framework;
5. Results;
6. Discussion of results;
7. Conclusions.

(https://students.usask.ca/graduate/thesis-preparation.php#ManuscriptStyleThesesandDissertations)

While you've done the first four, I think number 6&7 with the discussion of the results and the conclusion could use a little bit of work. You've done a great job writing out all of the findings, though I'm left really intrigued on what many of them mean - what's your overall objective for this research? While there is some discussion of the findings, there are areas where the findings are simply restated without offering an interpretation of what they mean for policy/practice. For example, what do those geographic trends mean? What does the distribution of references across the ACE elements tell us? I apologize if this is in there and I'm simply missing it. If that's the case then perhaps structuring the final chapter to offer a very easy to follow interpretation of the findings that directly answer your main research question (*"How do Annex 1 Parties approach CCE", p. 4 of your introductory chapter)*. I was told to really work on the thread that I weave throughout my writing, to ensure that the beginning ties nicely to the end.

For example, in your abstract you identified multiple key themes from your findings: "Key themes that emerged from the analysis of discussions of the ACE elements included: geographic trends, government and other actors' roles, the relative focus of learning dimensions, formal and non-formal education in the schools, purposes of training, focus on public awareness, types of information that public has access to, means of public participation, and approaches to international cooperation." Can you distill this down some more to identify what is most meaningful about the most common themes and how it answers your main research question? For example, in your abstract you write "this thesis work can further inform and support intergovernmental organizations' monitoring and evaluation of member states' CCE commitment" so in your conclusion could you possibly explain the CCE commitments? Or, how can the findings help "inform the annual ACE dialogue held by the Secretariat" (as written in your abstract)? Or, can your conclusion comment on the "Annex 1 Parties' progress on CCE" (again, from the abstract) in some way? As you can see, I'm pulling from your abstract and introductory section and tying to your conclusion as that is how you want to structure your thesis - introduce the gaps that you are going to fill, then fill them with your research. In your abstract, mention the most important contributions of your research that you cover in your conclusion. I'm sure you know most of this already, it's the challenge of getting it all down in the document and for it to read clearly to an outsider (this is the biggest challenge I had with my thesis! I really had to work on carrying the 'thread'/message throughout my document so that it was easy for my readers to follow).